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*Research Article*

### **Longevity of World War II Estonian volunteers in the Finnish Army: A follow-up study of the impact of the post-war life course and repressions**

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# **Longevity of World War II Estonian volunteers in the Finnish Army: A follow-up study of the impact of the post-war life course and repressions**

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## **Abstract**

### **BACKGROUND**

The existing literature pertaining to the long-term effects of war-related adversities on longevity is almost exclusively covering veterans from Western countries, while little is known about the longevity of surviving veterans in Eastern Europe.

### **OBJECTIVES**

We analyse the effects of the post-war life course, including politically motivated repressions, on the longevity of a group of WWII participants – Estonian volunteers in the Finnish Army.

### **METHODS**

We use a follow-up database of individual-level life histories of 3,352 Estonian men who served in the Finnish Army during WWII. The war and its aftermath divided them into several subgroups in a way that resembles a natural experiment. Using Cox proportional hazards models, we compare the mortality risks of subgroups whose members lived in different contexts after WWII.

### **RESULTS**

The marked advantage in longevity of veterans who lived in exile in Western countries relative to those who stayed in Estonia reveals an impact of the macrosocial environment on longevity. The results also show immediate and delayed effects of repressions on longevity. Excess risk associated with repression emerged several decades after exposure, while the scarring effect later disappeared representing cohort inversion.

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## **CONCLUSIONS**

The results corroborate that the sequelae of war-related repressions affect the surviving population for many decades, while the scarring effects may remain undetected in the presence of other mechanisms, such as selection based on differential mortality.

## **CONTRIBUTION**

The article presents the results of the first long-term follow-up study on the mortality effects of a group of WWII veterans from the Eastern bloc.

## **1. Introduction**

A relatively narrow but interesting subfield of mortality studies pertains to the survivors of war-related adversities. As empirical investigations into the long-term impacts of war-related adversities presuppose lengthy observation periods, the first notable contributions to this topic appeared only several decades after the two major international conflicts of the 20<sup>th</sup> century: World Wars I and II.

In one of the first follow-up studies, Nefzger (1970) and Keehn (1980) track members of the US Armed Forces taken captive during WWII and examine the excess post-war mortality of Pacific prisoners, which diminished over time but persisted for approximately a decade after the war. This branch of follow-up studies has considerably expanded over the last two decades, during which the cohorts affected by the war have passed away. The groups of survivors studied include war veterans (Bedard and Deschênes 2006; Bramsen et al. 2007; Saarela and Finnäs 2012), prisoners of war (POWs) (Page and Brass 2001; Costa 2012; Solomon et al. 2014), and affected civilian populations (Collins et al. 2004; Sagi-Schwartz et al. 2013; Fund et al. 2019).

While the bulk of the literature in this field relates to WWII survivors, there are a few studies on the aftermath of earlier conflicts, such as Costa (2012) on the US Civil War, and also some that explore the impact of post-WWII conflicts, such as the Korean War (Page and Ostfeld 1994; Page and Brass 2001), the Vietnam War (Boehmer et al. 2004), and the Iraq War (Mitchell et al. 2013).

The meta-analysis of Roelfs et al. (2010), which includes 30 studies on war-related stress exposure and mortality, reveals heterogeneous results across different eras, wars, affected groups, and types of exposure. They suggest that the differential impacts may, among others, relate to specific locational contexts and conditions that shape the long-term outcomes of war-related adversities, as well as to factors that moderate or obviate potential deleterious effects. In broader terms, these observations relate to the classical controversy of universal versus context-specific effects – to what extent are the factors

and mechanisms that shape the longevity outcomes of survivors of war-related adversities universal across time and space, and what is the scope of context-specific variations.

As Roelfs et al. (2010) also observe, nearly all of the earlier studies on this topic are based on data from Western countries. The highest number of studies pertain to survivors in the United States (Nefzger 1970; Keehn 1980; Page and Ostfeld 1994; Page and Brass 2001; Boehmer et al. 2004; Bedard and Deschênes 2006; Boscarino 2006; Elder et al. 2009). There are also some studies of survivors in Australia (Dent et al. 1989), Denmark (Olsen et al. 2015), the Netherlands (Saarela et al. 2007; den Welde et al. 2011), Finland (Saarela and Finnäs 2012), and Israel (Collins et al. 2004; Sagi-Schwartz et al. 2013; Solomon et al. 2014; Fund et al. 2019), but the geography of the respective studies is uneven. To date, there are virtually no such studies from Eastern Europe, despite the fact that the countries in that region were heavily affected by WWII and its aftermath. The likely reason for the absence of such studies is the lack of comprehensive individual follow-up data on survivors over long periods of observation.

Moreover, although there are several historical and descriptive accounts of the Soviet systems of repression and labour camps (e.g., Applebaum 2003; Shearer 2009; Ivanova et al. 2015), there have been no follow-up studies on later-life mortality of survivors of the Soviet mass repressions, which have been characterised as particularly harsh during the Stalinist era.

In this article, we undertake a study on the effects of the post-war life course, including the effects of Soviet repressions, on a particular group of WWII participants. We benefit from a unique database that includes the life histories of over 3,300 men who participated in WWII as Estonian volunteers in the Finnish Army. Given the character of the data, we are able to follow the life course of these veterans over a period of more than 70 years since the end of WWII in May 1945.

The war and its aftermath divided this group of WWII participants into several distinct subgroups, which makes this resemble a natural experiment. Whereas a relatively small proportion were killed during the war, those who survived followed different paths: Some escaped into exile after the war and lived in Western countries (mainly Sweden, Canada, and the United States), while others returned to Estonia (mainly after demobilisation from the Finnish Army in August and September of 1944). The latter group was further divided between those who were repressed by the Soviet regime – executed or sentenced to prison or forced labour camps – and those who lived in Soviet Estonia without experiencing such repression.

Using Cox proportional hazards models, we analyse the mortality risks of war survivors in association with their post-war life course. The presence of distinct subgroups permits us to scrutinise the impact of the macrosocial environment and repressions on the post-war survival of veterans. To the best of our knowledge, this is the first long-term follow-up study on the mortality effects of WWII survivors from the Eastern bloc.

The article is divided into six parts. Following the introduction, the second section provides an overview of previous findings pertaining to the later-life mortality of the survivors of war-related adversities. Section 3 gives a historical overview of the study population. Section 4 describes the data, research questions, and analytical approach, and Section 5 presents both the descriptive and multivariate results. The final and sixth section contains a summary and discussion of the results.

## **2. Theoretical perspectives and previous findings**

In the 1980s some early aggregate-level analyses were undertaken of post-war cohort mortality in war-affected countries, which interpreted the elevated mortality rates as a consequence of war. Okubo (1981) and Horiuchi (1983) observe a cohort variation in adult mortality in Japan and Germany, respectively, and linked it to the long-term influences of warfare and deprivation (such as malnutrition) experienced under harsh conditions (during WWII and WWI, respectively) on the mortality of survivors. With regard to the Soviet Union, Anderson and Silver (1989) compare the regional patterns of cohort mortality in Soviet republics 1958–1987 and attributed the cohort effects to WWII as elevated mortality rates were observed in the European regions of the Soviet Union, which were the ones most severely affected by the war.

More recent individual-level studies investigating the effects of war-related adversities on mortality/longevity have mainly employed two analytical strategies. The first strategy is to compare the mortality rates of exposed and non-exposed groups (or ‘treatment’ and ‘control’ groups), such as veterans versus non-veterans (Den Velde et al. 2011; Saarela and Finnäs 2012) or POWs versus non-POW veterans (Page and Brass 2001). This strategy allows excess mortality due to exposure to a particular adversity to be assessed. However, when taking this approach one has to be aware of a potential initial selection bias if the exposed group was in some way selected (or self-selected) prior to exposure (Bedard and Deschênes 2006).

Another approach has been to assess the relative mortality risks of subgroups of the exposed population that were subjected to different kinds of adversities, such as combat experience, wounds, or imprisonment. For instance, Elder et al. (2009) observe that exposure to combat significantly increased the lifelong mortality risks of US WWII veterans. Roelfs et al. (2010) note a slightly elevated mortality risk for veterans who had been exposed to a combat zone relative to non-exposed military personnel during the Vietnam War. Bramsen et al. (2007) observe higher mortality risks of Dutch WWII veterans and war survivors who had been seriously wounded. This approach is not compromised by selection bias provided that the adversity was random.

A number of empirical studies have revealed significant long-term negative effects of war-related adversities on longevity (Hearst, Newman, and Hulley 1986; Gale et al. 1999; Page and Brass 2001; Bedard and Deschênes 2006; Den Velde et al. 2011). Such effects are explained by the long-term impact of severe stress, prolonged malnutrition, poor sanitary conditions, exposure to injuries and diseases, and limited healthcare in times of military conflicts or during imprisonment, which have potentially damaging health effects later in life and consequently reduce life expectancy (Page and Ostfeld 1994; Sagi-Schwartz et al. 2013).

It is well documented that being exposed to life-threatening episodes in a war zone (such as combat) and experiencing other war-related adversities entail a risk of post-traumatic stress (e.g., Hines et al. 2014). A large number of studies associate elevated post-war mortality rates with post-traumatic stress disorder and other mental health problems, as well as with military-induced smoking and heavy drinking (Boscarino 2006; Bedard and Deschênes 2006; Bramsen et al. 2007; Elder et al. 2009; Den Velde et al. 2011; Solomon et al. 2014; Olsen et al. 2015). These findings suggest that the post-war behavioural response is a significant mediating factor influencing the long-term mortality of survivors of war-related adversities.

By contrast, other studies have shown either only short-term effects on mortality or mixed results. Saarela and Finnäs (2012), analysing whether Finnish men in birth cohorts with WWII experience had higher later-life mortality, observe a short-term post-war effect whereby death rates remained relatively high in the first years after the war, but no elevated mortality among war survivors after the early 1950s as compared with younger cohorts who had no combat experience.

The literature offers several explanations why studies have failed to find sustained negative outcomes of war-related adversities. Saarela and Finnäs (2012) credit the absence of long-term negative effects to cohort inversion. This phenomenon may be viewed as an outcome of selective mortality or other mechanisms with a similar effect over time. As posited by Hobcraft, Menken, and Preston (1982), cohorts experiencing particularly hard times early in life tend to respond inversely later in life. The heterogeneity of the response within the cohort entails that those who are more susceptible die at younger ages while the cohort mortality of survivors is reduced in later life.

In their meta-analysis of the relationship between war-related stress and mortality, Roelfs et al. (2010) show that exposure to war-related stress did not significantly increase the risk of death in well-controlled studies. They ascribe this finding to selection processes, resilience, and/or institutional support for survivors. Resilience can be viewed as an adaptive characteristic that allows some survivors of adversity to cope with and recover from any adversity encountered in their lives. There is an increasing volume of literature on post-traumatic growth, whereby survivors of adversity develop strengths and

coping skills in response to their experience (Feder et al. 2008; Mitchell et al. 2013; Staugaard et al. 2015; Mark et al. 2018). As regards institutional support, Roelfs et al. (2010) note that in many Western countries veterans receive lifelong medical care and counselling, as well as social recognition and respect, which may help to counterbalance the negative effects of adversity. Zarulli (2013) makes an observation that when analysing the effects of exposure to extremely harsh conditions on adult mortality, other underlying mechanisms beyond selection could produce a similar age pattern.

Sagi-Schwartz et al. (2013) undertook a retrospective cohort study of young survivors of the Holocaust who migrated from Poland to Israel after WWII (1945–1950); they put forward differential mortality during captivity and post-traumatic growth or resilience as two plausible explanations for the absence of excess mortality. The study finds that the Holocaust survivors had a reduced risk of death and higher life expectancy relative to their counterparts from the same birth cohorts who had migrated from Poland to Israel before WWII. Similarly, Fund et al. (2019) note considerably higher survival rates of Holocaust survivors compared with an age-matched control group born in Israel after controlling for potential confounders and attribute this to the higher resilience of Holocaust survivors that allowed them to better cope with and recover from adversity (see also Collins et al. 2004).

Individual characteristics, such as the age at which the adversities were experienced, or military rank, have been shown to modulate mortality outcomes. For instance, Costa (2012) observes that US Civil War POWs younger than 30 at the time of imprisonment faced higher mortality in old age, whereas those who were older than 30 when they were taken prisoner had a higher mortality rate in captivity than younger men. However, survivors of prison camps had a lower older-age death risk, which indicates that older men who had survived POW camps may have been more robust or resilient.

In summary, the literature has identified a series of factors that plausibly influence the later-life mortality outcomes of survivors, including sociodemographic characteristics, the nature and severity of the adversity, and the post-war life course and social environment. In other words, the effects of experiencing war-related adversities on post-war longevity and the mortality differences among survivors have been linked to individual factors (such as age at the time of exposure to adversities); the type of adversity (such as combat exposure, wounding, imprisonment, and length of captivity) and its impact; the individual behavioural response that reflects the extent of resultant ‘scarring’ (e.g., post-traumatic stress) and health risks (such as smoking and alcohol consumption); and the social environment in later life during the post-war years (such as living standards and the provision and quality of healthcare). However, the evidence remains somewhat inconclusive, as some factors have been shown to contribute to increased later-life mortality in some studies, but not in others.



As regards the mechanisms shaping the outcomes, previous studies present a mixed picture. There is extensive evidence of the long-term negative effects of debilitating events leading to higher old-age mortality. However, there is also a strong case for mortality selection and cohort inversion, whereby frail individuals in the affected group die at younger ages, which leads over time to a relative increase in the number of more robust individuals surviving to higher ages. Finally, an increasing number of studies point to the importance of resilience and post-traumatic growth.

### **3. The study population**

WWII involved two episodes of military conflict between the Soviet Union and Finland: the Winter War 1939–1940 and the Continuation War 1941–1944 (Jowett and Snodgrass 2006). In both cases, the Finnish Army included groups of volunteers from neighbouring countries.

During the Winter War of 1939–1940 the number of Estonian volunteers was quite small – approximately 100. The number of Estonian volunteers began to increase during the years of the Continuation War, in particular from the spring of 1943. At that time, Estonia was occupied by the Nazis and the main motivation to escape to Finland was to evade recruitment into the German Army (Uustalu 1977).<sup>3</sup> Fleeing to Finland involved significant risks due to the stormy weather on the Finnish Gulf, and the fact that leaving the country illegally was considered a criminal offence by the Nazi administration punishable by sentencing to forced labour.

Apart from the two prevailing destinies of young Estonian men during the years of the Second World War – involuntary recruitment into the Soviet Red Army 1940–1941 or into the German Wehrmacht 1941–1944 – fleeing the occupied country and joining the Finnish Army was considered a ‘third way’ (Uustalu 1977; Kuutma 2004). Following this third way entailed an active course of conduct – resistance to Soviet and German conscription and escape to the neighbouring country.

Upon their arrival in Finland most of the fugitives enlisted as volunteers in the Finnish Army, underwent medical examinations, and received military training. In February 1944, a new Finnish Army regiment – Infantry Regiment 200 (IR200) – was formed from Estonian recruits. By June 1944 IR200 included approximately 2,400 Estonians (Laar et al. 2010). A number of recruits participated in officer training and in courses for non-commissioned officers (Uustalu and Moora 1993). Approximately 400 Estonian volunteers served in the Finnish Navy, comprising nearly 10% of total navy personnel (Relvik 2003).

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<sup>3</sup> Recruitment into the German Army was announced in February 1943 for men born 1919–1924 and in October 1943 for men born in 1925.

In mid-August 1944 the IR200 was dissolved and the Estonian volunteers were given a choice between returning to Estonia or staying in Finland. An overwhelming majority choose to return to Estonia in order to defend the homeland against the Red Army offensive (Uustalu 1977). Of the volunteers who returned to Estonia, more than 500 men participated in battles on Estonian soil in September 1944.

When the German troops retreated and the Red Army reconquered Estonia in the autumn of 1944, many former Finnish Army volunteers along with nearly 80,000 civilians fled to Sweden and Germany. Many others attempted to escape but failed due to lack of transportation (Kumer-Haukanõmm, Rosenberg, and Tammaru 2006).

In total, over the period 1939–1944 more than 3,350 Estonian volunteers served in the Finnish Army and Navy. A significant majority of them – around 78% – participated in front-line combat, mainly in the ranks of IR200 over the summer of 1944 in battles against Red Army offensives on the Karelian Isthmus. However, war casualties were relatively few. The death toll among the volunteers in the course of military service and battles in Finland reached 180. Another 84 men were killed in battle in Estonia, along with several dozen in the final battles of WWII on other soil. More than 2,900 Estonian volunteers survived the war and were alive as of 9 May 1945.

Soviet authorities regarded volunteers who had fought against the Red Army, evaded Soviet mobilisation, or attempted to flee to the West as traitors and subjected them to various forms of repression. However, a relatively high number of former volunteers were not repressed: Some escaped repressions by concealing their wartime activities or falsifying documents, others joined the Red Army or were saved from repressions by other means (Saueauk 2010).

The peak of post-war repression coincided with the onset of the second Soviet occupation of Estonia in late 1944 and 1945. A total of 18 Estonian volunteers received the death penalty, but several more were killed in the process of being arrested. More than 400 volunteers were sentenced to forced labour camps for periods of 10 to 25 years, with a further limitation on civil and political rights for an additional three to five years. Approximately 80 volunteers received sentences of less than ten years' imprisonment.

The conditions in the forced labour camps of the Gulag have been described as particularly harsh and inhumane: exhausting physical labour in long (12-hour) shifts with little regard to working conditions and safety, malnutrition, unsanitary conditions, infectious diseases, lack of proper medical care, violence on the part of other prisoners, and harsh climatic conditions in remote areas of Russia (Saueauk 2010; Alexopoulos 2017). Many inmates did not survive these conditions. The death toll was particularly high during the first years following the war, 1945–1947.

Soviet repression softened after the death of Joseph Stalin in 1953. The sentences of some convicted volunteers were reduced, and some were released under the mass amnesty of 1955. Volunteers who had survived imprisonment were released from the

camps mainly from 1953 to 1956. Nearly all of the released volunteers returned to Estonia. Upon their release from labour camps the former detainees remained under surveillance by the KGB. They were restricted from travelling abroad and their possibilities for career advancement were often hindered.

After Estonian independence was restored in 1991, the social status of survivors changed dramatically from the early 1990s, and institutional support associated with their status was provided. The former detainees were accorded the status of unlawfully repressed persons and their sentences annulled. The surviving volunteers in Estonia became eligible for support from both Estonia and Finland. Estonia introduced pension supplements for those who were repressed during the Soviet period, and Finland paid veterans supplements and provided rehabilitation services in Finland. Over 150 surviving volunteers were decorated by Estonia or Finland.

While the number of Estonian volunteers in the Finnish Army was relatively small,<sup>4</sup> there are two aspects that make this group of veterans particularly suitable for studying the mortality outcomes of war-related adversities: first, distinctly different post-war life-course patterns, and second, the availability of follow-up life-course information on nearly the entire group. We acknowledge that compared with the larger groups of men who were subject to Soviet or German conscription, the ‘third way’ group of Estonian volunteers in the Finnish Army had a younger, ‘adventurer’ profile, as choosing this option was mainly available to specific age cohorts and involved an active decision to escape to Finland. However, these aspects are secondary to the analysis as the research strategy involves a comparison of subgroups of volunteers, which emerged in the course of a natural experiment.

## **4. Data and methods**

### **4.1 Database of Estonian volunteers**

Our database is extracted from individual biographies that were compiled in cooperation with historians and veterans’ organisations in the 1990s (Kuutma 1997). We rely on the most recent and complete volume of biographies, published in book form by Pillak and Vilbiks (2015). The authors of the book also provide us with updated information on the survival status of the volunteers up until the beginning of 2018. The diverse source materials on which the biographies were based range from Finnish and Estonian archives to information obtained from the volunteers and their families and Estonian diaspora organisations. Registers of repressed persons compiled by the Estonian Association of

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<sup>4</sup> During WWII, approximately 72,000 and 68,000 Estonians were conscripted into the Soviet and German armies, respectively.

Illegally Repressed Persons MEMENTO (Õispuu 1996; Õispuu 1998; Õispuu 2005) were an additional significant source of information on volunteers who experienced Soviet repression.

Our database comprises information on 3,352 men. The biographical material was coded by the first author of this article. Although the biographical format used by the volunteer organisations is brief, it contains information about the volunteers' background, survival status, war experience, and post-war life course.

The background information includes the date and place of birth. More than 75% of the volunteers were born between 1918 and 1926; 63% were born in rural areas, 34% in urban areas, and 3% outside Estonia.

With regard to survival status, at the beginning of 2018, 103 volunteers (3.1%) were still alive and 3,137 (93.6%) men are known to have died. The survival status is unknown for 112 volunteers (3.3%) of whom the veterans' organisation has lost track. The date of death was not known for nine men who did not survive. The biographies also provide some information on the circumstances of death. This information is fairly complete for wartime deaths and those related to repression.

The information concerning service with the Finnish Army includes military rank, army units in which the individual served, and military honours. Overall, 83% of the volunteers were in the lower ranks, 9% were non-commissioned officers, and 8% were officers. Information on combat experience in different theatres (Finland, Estonia, and other locations) is also available from the biographies. On the basis of this information we constructed a cumulative measure according to which 62% of the volunteers had a single combat experience, 18% had multiple experiences, and 20% were not exposed to combat. A total of 15% of the surviving volunteers sustained wounds and injuries that were not fatal.

The war and its aftermath divided the surviving volunteers into several distinct groups: 370 men (11%) died before the end of war, and 1,289 (39%) escaped to Western countries (mainly Sweden, Canada, and the United States) afterwards. Another 1,581 (47%) remained in Estonia, which was subjected to the second Soviet occupation in 1944.

We have divided the volunteers who returned to Estonia into two subgroups – those who were subjected to repression during the period of Stalin's rule and those who were not repressed. In our study, we considered only harsh forms of repression, such as those causing death, detention in prisons or forced labour camps, and deportation. According to this definition, 593 volunteers were identified as having been subjected to repression (18% of the study population). Of these, 132 (22%) died as a direct consequence. The biographies and registers provide information on the court sentences, start and end dates of detention, and the location of the prisons and labour camps. We used this information to construct a measure of duration of detention; the median length of detention was 6.5 years.

The information available from the volunteers' biographies is too crude to attempt to formulate detailed educational and work histories. However, as Pillak and Vilbiks (2015: 17) note, the material provides a realistic general account of the post-war socioeconomic status of the study population. We were able to use the information to construct measures of educational attainment and occupation. Given the limitations of the material, we distinguished only two levels of education (tertiary; secondary or primary) and two occupational groups (managerial and professional; other occupations). Of the study population, 13% had received tertiary education and 20% held managerial or professional jobs.

The long-term efforts of veterans' organisations to collect information have ensured a reasonably high quality of survival data. The records of only 121 men out of 3,352 (3.6%) had to be excluded from the analysis because of missing data on survival status and/or date of death. If we disregard those whose survival data are missing, the information on the volunteers' military service in Finland and the path they followed after their release from the Finnish Army is virtually complete, with the number of cases of missing data in single digits. We trust that the data pertaining to those subjected to repression are also fairly complete since the information from the volunteers' biographies has been checked against the registers of repressed persons. Our data are less complete for education and occupation. However, we think that the simple categorisation described above is sufficient to distinguish men who attained higher socioeconomic status.

Table 1 presents the characteristics of our study population and its subgroups according to the volunteers' post-war life course. The data reveal some noticeable differences between the subgroups. For instance, although the proportion of officers is quite small, it is higher among volunteers who escaped to the West. This may reflect a perceived risk of being subjected to repression by the Soviet regime – the evidence presented in the table indicates that this fear was not unfounded<sup>5</sup> – or better connections and resources that facilitated the officers' escape. In keeping with the higher proportion of officers, the men who escaped abroad were also somewhat older. Another visible difference relates to post-war socioeconomic status. The subgroup comprised of volunteers who left Estonia includes the highest proportion of men who received a tertiary education and who worked in managerial or professional occupations. By contrast, higher post-war socioeconomic status is almost three times less prevalent among men who were subjected to repression. All of these differences associated with individuals' characteristics can be considered in the analysis.

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<sup>5</sup> There is a 78% probability that officers who stayed in Estonia were subjected to severe repression.

**Table 1: Main characteristics of the study population by subgroups, Estonian volunteers in the Finnish Army (%)**

Characteristics	Died before 9 May 1945	Escaped to the West	Returned to Estonia			All groups
			All	Repressed	Not repressed	
<i>Age in May 1945</i>						
Under 20	-	9.6	14.7	13.1	15.7	12.4
20–24	-	49.6	56.8	53.4	58.7	53.5
25–29	-	20.7	13.7	15.9	12.3	16.8
30–34	-	11.2	8.9	10.8	7.8	9.9
35–39	-	4.8	4.4	5.3	3.8	4.5
40 or older	-	4.1	1.5	1.5	1.5	2.7
<i>Place of birth</i>						
Rural area	60.2	59.9	66.3	62.5	68.4	63.0
Town	36.0	36.3	32.2	35.3	30.4	34.3
Foreign country	3.5	3.5	1.4	2.0	1.0	2.5
Missing	0.3	0.3	0.1	0.2	0.1	0.2
<i>Military rank in Finnish Army</i>						
Lower ranks	83.5	80.4	84.9	75.3	90.6	82.9
Non-commissioned officers	8.9	9.3	9.3	12.7	7.3	9.3
Officers	7.0	10.4	5.8	12.0	2.0	7.7
Missing	0.5	0.0	0.0	0.0	0.0	0.1
<i>Combat experience</i>						
None	16.0	34.1	8.9	10.5	8.0	19.8
Single	52.0	56.7	68.5	66.3	69.8	61.9
Multiple	32.0	9.2	22.5	23.2	22.2	18.3
<i>Wounded/injured</i>						
No	-	83.2	87.7	88.8	86.9	85.0
Yes	-	16.8	12.3	11.2	13.0	15.0
<i>Education</i>						
Tertiary	0.3	18.0	11.1	6.1	14.1	12.6
Secondary or lower	99.7	82.0	88.9	93.9	85.9	87.4
<i>Occupation</i>						
Managerial/professional	0.0	30.0	16.9	10.0	21.0	20.2
Other occupational groups	100.0	70.0	83.1	90.0	79.0	79.8
Number of men	370	1289	1581	988	593	3240

Note: Men lost from tracking are not included in the table.

Source: Database of Estonian volunteers in the Finnish Army, authors' calculations.

The selection of volunteers into subgroups is linked to two major turning points that shaped the subsequent life course of the volunteers: fleeing to the West or experiencing repression in Estonia. While fleeing to the West in the autumn of 1944 entailed a conscious decision in most (but not all) cases, success or failure also depended on unpredictable situational factors beyond the control of individuals.<sup>6</sup> Among those who

<sup>6</sup> Situational factors include weather conditions that permitted or prevented escape across the sea and the availability of means of transportation. Over 200 men retreated or were evacuated to Germany by German troops; more than 80 of them were later captured by the Red Army, and the majority were subsequently subjected to repression. About 15 men perished while attempting to escape. More than 30 men were captured by the Soviets while attempting to escape and later subjected to repression for that reason, and another 15 men were extradited from Finland to the Soviet Union.

did not flee the country, selection into groups who were or were not repressed was clearly not based on individual choice. It is reasonable to assume that the overwhelming majority of volunteers who remained in Estonia wished to avoid repression, but not all succeeded. These considerations support the assertion that the selection of volunteers into subgroups resembled a natural experiment.

## **4.2 Research questions and analytical approach**

Our research interest in this study relates to the associations between the volunteers' post-war life course and survival. In order to investigate these associations, we focus on men who survived the war. Their survival outcomes enable us to address three research questions.

The first question pertains to the influence of post-war repression on the mortality risks of the volunteers. A second, related question concerns potential delayed effects of the repression. Answers to these two questions are sought by comparing the subgroups of men who stayed in the country at the end of the war. Guided by previous studies, we expect to find a pronounced negative overall effect of repression on survival. The literature review in the theory section of the article identified several mechanisms (scarring, selection, and post-traumatic growth) that can affect the long-term survival of individuals exposed to stress associated with imprisonment. The opposite directions of the long-term effects produced by these mechanisms make it difficult to predict the prevailing pattern among our study population. The third research question relates to the association between survival and the societal regime. Comparing the survival of the group who lived in exile in Western countries with those who stayed in Estonia provides an interesting longitudinal perspective on the East–West mortality differential, which has attracted considerable interest in literature (Hertzman, Kelly, and Bobak 1996; Meslé and Vallin 2017).

The analysis is comprised of two parts. In the introductory section, the survival of the volunteers is examined via descriptive measures (mean age at death and survival curve). Further, survival is modelled using Cox regression. Time at risk is measured with monthly precision, starting in May 1945; the volunteers are followed until death or censoring at the beginning of 2018. After excluding those who died during the war, those who could not be tracked, or those whose date of death is unknown, the records of 2,861 individuals have been included in the multivariate analysis.

We estimate a series of main effects models and monitor the change in the effect of our main independent variable (subgroups of volunteers) as other covariates are added in a stepwise procedure. The initial model (M1) is not adjusted for the effects of the control variables. In the second model (M2), age at the beginning of the observation period,

birthplace, and military rank are added. Model M3 adds two variables controlling exposure to war-related stress (combat experience and the incidence of war wounds/injuries). Model M4 (the final model) also includes variables for educational attainment and occupation. In order to identify the long-term effects of repression, we rerun the models excluding those who perished as a direct consequence. Finally, in order to determine the role of various mechanisms that engendered the long-term effects of repression, we introduce an interaction between the calendar period and our main independent variable.

## **5. Results**

### **5.1 Descriptive results**

Table 2 presents the mean age at death for the subgroups of volunteers. Given that more than 70 years have passed since the war ended, and only a small proportion of men are still alive at the end of the observation period, age at death offers a close approximation of the differences in life expectancy between the subgroups.

Among the volunteers who survived the war, the lowest mean age at death (60.5 years) is characteristic of those who were subjected to repression. Volunteers who returned to Estonia but were not repressed have a noticeably higher mean age at death (68.4 years). The eight-year difference provides a rough estimate of the years of life lost due to repression. Volunteers who left the country and settled in the West exhibit the highest mean age at death (71.9 years) of the three subgroups. The lifespan of the latter group is six years longer than that of the volunteers who lived in Estonia. The exclusion of those who were subjected to repression reduces the gap by 40%, but a substantial disadvantage remains for the volunteers who returned to Estonia relative to their counterparts who escaped to the West.

Figure 1 gives a more detailed account of the survival of the different subgroups of volunteers. The survival curves indicate that for men who were subjected to repression, the most perilous years were those immediately following the war. According to biographical data, 32 men died from May to December 1945 as a result of repression; in 1946 the number was only slightly smaller (28). In addition to deaths that occurred in captivity, the figures also include executions of death sentences and deaths that occurred during round-ups and arrests. In the following years, the death toll decreases, with 18, 11, and 9 repression-related deaths occurring in 1947, 1948, and 1949, respectively. In the early 1950s, the number of such deaths further decreases. This decrease in mortality was an outcome of several factors, such as a gradual improvement in the conditions in prisons and labour camps, and selection (men who died in the first years of captivity were



plausibly less robust than those who survived). By the time of the death of Stalin in March 1953, nearly 20% of the volunteers who were subjected to repression had died.

**Table 2: Mean age at death, number and proportion of survivors by subgroups, Estonian volunteers in the Finnish Army**

Characteristics	Died before 9 May 1945	Escaped to the West	Returned to Estonia			All groups
			All	Repressed	Not repressed	
Mean age at death in years	22.9	71.9	65.5	60.5	68.4	63.0
Number of survivors	0	65	38	12	26	103
Proportion of survivors, %	0.0	5.1	2.4	2.6	2.0	3.2

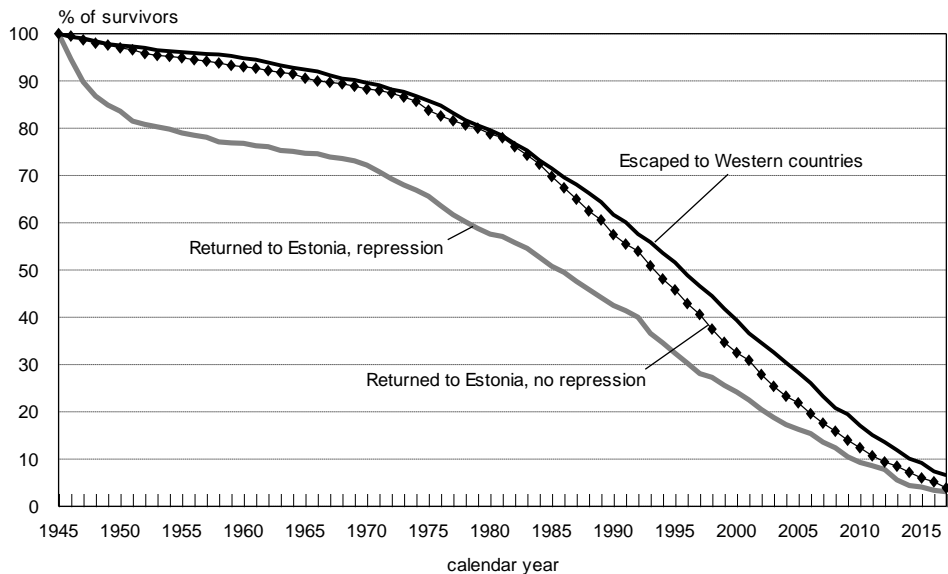
Note: Number and proportion of survivors as of the beginning of 2018. Men lost from tracking are not included in the table.

Source: Database of Estonian volunteers in the Finnish Army, authors' calculations.

The survival rates among the other subgroups were much higher in the early post-war years. Interestingly, among those in Estonia who were not repressed, the proportion of survivors was for several decades only marginally lower than that of their counterparts living in Western countries. In the early 1980s, the difference between the two groups was within one percentage point. This result is somewhat unexpected given the prolonged stagnation in mortality rates that began in the late 1960s and persisted until the mid-1990s in Estonia, and which was particularly pronounced among men of working age (Katus 2000; Vallin, Jasilionis, and Meslé 2017). According to our data, a larger disadvantage in the proportion of survivors emerges only after 1985, but it increases and persists well into the 21<sup>st</sup> century.

Another noteworthy feature of the later part of the observation period concerns the volunteers who were subjected to repression. As shown in Figure 1, the decrease in the proportion of survivors in this subgroup seems to have decelerated relative to the others beginning in the late 1980s. As a consequence, the disadvantage for the surviving men who had been subjected to repression gradually diminishes towards the end of observation period, especially relative to those who lived in Estonia but were not repressed. However, it is advisable to avoid drawing conclusions based on the descriptive findings since the measures employed in this section do not take into account numerous differences between the subgroups.

**Figure 1: Proportion of survivors by subgroups, Estonian volunteers in the Finnish Army**



Source: Database of Estonian volunteers in the Finnish Army, authors' calculations.

## 5.2 Multivariate results

In this section, we report the hazard ratios of dying that were obtained from the Cox regression models. The estimates presented in Table 3 are based on all members of the study population who survived the war. Corroborating the descriptive results reported above, in the initial model (M1) subjection to repression is related to a significantly elevated risk of dying compared with volunteers in Estonia who did not experience repression. By contrast, men who settled in Western countries exhibit a noticeably lower mortality risk than the reference group.

The inclusion in the model of age at the beginning of observation, birthplace, and military rank produces a moderate increase in the survival advantage associated with residence in Western countries (M2). The change stems from the adjustment for age differences between the groups; the volunteers who left Estonia were somewhat older than those who returned. Adding controls for war-related stress makes only a marginal difference in the hazard ratios (M3). The inclusion of education and occupation results in a reduction in the hazard ratio for those who were subjected to repression. This suggests that the mortality disadvantage of the latter group stems partly from lower socioeconomic

attainment. In the final model (M4), exposure to repression is associated with a 19% increase in the hazard of dying, whereas living in Western countries is associated with a 22% reduction. We attribute the latter difference to the societal context and the former to repression.

The results presented in the upper panel of Table 3 reflect the combined outcome of the immediate and long-term effects of repression. In order to measure the long-term effects, we excluded from the working sample 132 men whose death was directly attributable to repression and reran the models. The estimates from these additional models reveal no substantial difference between the volunteers who experienced repression and the reference group (lower panel of Table 3). In models M1, M2, and M3, the mortality risks for the former and latter groups are identical. In the final model (M4), the volunteers who were subjected to repression exhibit an even lower risk of dying than their counterparts in the reference group, but the difference (6%) is not substantial.

The absence of a long-term mortality disadvantage associated with repression seems unexpected considering the harshness of the conditions in labour camps and prisons during the Stalinist era. This gives rise to the question of whether competing mechanisms, such as selection or post-traumatic growth, may have negated the long-term scarring effect of repression. In search of evidence to support this hypothesis, we focussed on those who survived repression and fitted an additional model for this group. In this model, we added duration of captivity as a proxy for exposure to repression-related stress.<sup>7</sup> The estimates reveal a positive relationship between the number of years spent in captivity and the subsequent mortality risk: An additional year in captivity increases the hazard ratio of dying by 4%. This means that the similarity of mortality risks between those who experienced repression and the reference group reported above should not be interpreted as the absence of a long-term disadvantage related to repression but rather as the presence of mechanisms that overshadow the scarring effects at the group level.

The descriptive measures presented in the previous section indicate that the differences in mortality risks between the subgroups of volunteers may have changed over time. In order to gain insight into the changes, we included an interaction between the calendar period and the subgroup. In the interaction model, we distinguished four periods (1945–1954, 1955–1969, 1970–1994, and 1995–2017). Delineation of the periods was guided by post-war mortality trends (Katus 2000; Vallin, Jasilionis, and Meslé 2017). Mortality was very high in Estonia in the late 1940s and early 1950s; for instance, in 1950 male life expectancy was still below the pre-war level. By contrast, from the mid-1950s to the 1960s the country exhibited a marked rise in life expectancy, particularly in the first half of the period. The 1970s and 1980s featured a prolonged stagnation in mortality rates, albeit with some fluctuations, followed by an upsurge in death rates during the rapid societal transformation in the early 1990s. Gains in life

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<sup>7</sup> The additional model (available on request) included the same controls as M4.

expectancy subsequently resumed, although a gap relative to Western countries still remains, particularly for men.

**Table 3: Hazard ratios of dying, main effects (Cox proportional hazards models), Estonian volunteers in the Finnish Army**

Subgroup of study population	M1	M2	M3	M4
<i>All volunteers who survived WWII</i>				
In Estonia, repressed	1.27 (1.15–1.41)	1.27 (1.14–1.41)	1.27 (1.14–1.41)	1.19 (1.07–1.32)
In Estonia, not repressed	1	1	1	1
In Western countries	0.85 (0.78–0.93)	0.78 (0.71–0.85)	0.76 (0.70–0.84)	0.78 (0.71–0.85)
<i>Volunteers who survived WWII, deaths related to repression excluded</i>				
In Estonia, repressed	1.00 (0.90–1.12)	1.00 (0.89–1.12)	1.00 (0.89–1.12)	0.94 (0.84–1.05)
In Estonia, not repressed	1	1	1	1
In Western countries	0.85 (0.78–0.92)	0.77 (0.71–0.84)	0.76 (0.69–0.83)	0.77 (0.70–0.84)

Note: 95% confidence intervals in parentheses.

Model M1: not controlled for other covariates.

Model M2: controlled for age as of May 1945, birthplace, and military rank.

Model M3: M2 additionally controlled for combat experience and war-related wounds/injuries.

Model M4: M3 additionally controlled for educational attainment and occupation.

Estimates for the control variables are presented in Table 5.

Source: Database of Estonian volunteers in the Finnish Army, authors' calculations.

The results from the interaction model reveal a somewhat complex change in the pattern over time (Table 4, upper panel). Not surprisingly, the largest contrast between the three subgroups is found in the first post-war decade. During that period, those who were subjected to repression had a mortality risk 6.4 times higher than the reference group. However, sizeable excess mortality (a 51% increase in the hazard ratio) was also characteristic of volunteers who did not experience repression. This is evidence of the hardship experienced by the general population under Stalin's rule. From 1955 to 1969, the differences between the subgroups sharply decreased. During that period, the volunteers in Estonia exhibited only moderately elevated mortality risks; the difference between them and their counterparts in the West is not substantial. From 1970 to the early 1990s, however, the contrasts between the subgroups increased again. The volunteers who stayed in the country and were not repressed experienced 30% excess mortality relative to the volunteers living in Western countries. For those who were subjected to repression, the difference was noticeably larger (45%). During the last period (from 1995 to 2017), the pattern changes again but not for all groups. There is only a minor change in the hazard ratio among the volunteers in Estonia who did not experience repression. By contrast, those who were subjected to repression exhibit a major decrease in the hazard ratio during the last period – from 45% to 11%. As a result, the difference between the latter and the reference group (volunteers living in the West) is no longer substantial.

**Table 4: Hazard ratios of dying, interaction between the subgroup and calendar period (Cox proportional hazards models), Estonian volunteers in the Finnish Army**

Subgroup of study population	Calendar period			
	1945–1954	1955–1969	1970–1994	1995–2017
<i>All volunteers who survived WWII</i>				
In Estonia, repression	6.41 (4.59–8.93)	1.22 (0.82–1.81)	1.45 (1.23–1.70)	1.11 (0.94–1.31)
In Estonia, no repression	1.51 (1.02–2.24)	1.19 (0.86–1.65)	1.30 (1.13–1.48)	1.26 (1.11–1.43)
In Western countries	1	1	1	1
<i>All volunteers who survived WWII; returnees to Estonia are merged into a single group</i>				
In Estonia, repression and no repression	3.33 (2.43–4.59)	1.20 (0.90–1.61)	1.35 (1.20–1.53)	1.22 (1.08–1.37)
In Western countries	1	1	1	1

Note: 95% confidence intervals in parentheses.

The interaction model is controlled for age as of May 1945, birthplace, military rank, combat experience, war-related wounds/injuries, educational attainment, and occupation.

Source: Database of Estonian volunteers in the Finnish Army, authors' calculations.

In order to provide an overview of the dynamics of the difference in mortality risks between volunteers who lived in Estonia and in the West, the lower panel of Table 4 contains estimates for all volunteers who returned to Estonia merged into a single group. Excluding the first post-war decade, the results from the 1970s to the early 1990s exhibit a distinct curvilinear pattern that features a hazard ratio 1.7 to 1.8 times higher than that of the preceding and subsequent periods. Since the middle of the 1990s, the excess mortality of the volunteers in Estonia is only marginally higher than it was during the late 1950s and 1960s – the period when the difference was least.

Finally, Table 5 presents the results for the control variables. As one would expect, age at the beginning of observation significantly increases the risk of dying: An additional year increases the hazard by 8%. By contrast, birthplace makes no substantial difference in mortality risks among the volunteers. This is also true for military rank, although in models M2 and M3, officers exhibited an 18% to 19% lower mortality risk than lower-ranking volunteers. The inclusion of controls for socioeconomic status in the final model reduces the survival advantage of officers. Interestingly, our controls for high war-related stress (multiple combat experience and wounds and injuries) are positively associated with survival: The mortality risks are reduced by 12% for both covariates. Finally, tertiary education and employment in managerial or professional occupations are associated with substantially reduced mortality risks, as expected.

**Table 5: Hazard ratios of dying, effects of the control variables (Cox proportional hazards models), Estonian volunteers in the Finnish Army**

<b>Control variables</b>	
<i>Age in May 1945</i>	1.08 (1.07–1.08)
<i>Place of birth</i>	
Rural area	1
Town	1.06 (0.98–1.15)
Outside Estonia	1.00 (0.91–1.11)
<i>Military rank in Finnish Army</i>	
Lower ranks	1
Non-commissioned officers	1.03 (0.90–1.18)
Officers	0.96 (0.83–1.11)
<i>Combat experience</i>	
None	1.00 (0.91–1.11)
Single	1
Multiple	0.88 (0.79–0.99)
<i>Wounded/injured</i>	
Yes	0.88 (0.78–0.99)
No	1
<i>Education</i>	
Tertiary	0.77 (0.67–0.88)
Secondary or lower	1
<i>Occupation</i>	
Managerial/professional	0.79 (0.70–0.89)
Other occupational groups	1

Note: 95% confidence intervals in parentheses.

The hazard ratios are based on the final model (M4) in Table 3 (upper panel).

Source: Database of Estonian volunteers in the Finnish Army, authors' calculations.

## 6. Summary and discussion of the findings

The aim of this study was to investigate the survival of Estonian volunteers who served in the Finnish Army during WWII. In the aftermath of the war, our study population was divided into subgroups with divergent life courses in a way that resembles a natural experiment. The majority of men who survived the war moved back to Estonia, where more than a third were subjected to Stalinist repression. However, a sizeable minority of the volunteers (more than two-fifths) settled in Western countries, especially Sweden, Canada, and the United States. In the article, we compared the survival of three subgroups of volunteers: those who were subjected to repression, those who returned to Estonia but did not experience repression, and those who escaped to the West. To the best of our knowledge, this is the first study that investigates long-term repression-related mortality outcomes in the Eastern bloc. In addition to focussing on a previously underexplored setting, our study contributes to the literature a unique life-history dataset that follows our study population over a period of 72 years. This provides a detailed survival account irrespective of the volunteers' country of residence during the post-war decades.

With regard to our first research question concerning the overall effect of repression, the results revealed a major survival disadvantage. In the final model, exposure to repression was associated with a 19% increase in the hazard of dying relative to those who were spared. Further elaboration of the results reveals that the disadvantage stems from the immediate consequences of repression, such as death during arrests and round-ups, execution of death sentences, and death in captivity. After eliminating the effects of these consequences, the survival disadvantage related to repression disappeared. This finding was unexpected as it implies a negative answer to our second research question with regard to the presence of a long-term scarring effect of repression on survival. However, as rejection of the scarring effect would have been at odds with the hard conditions in Stalinist prisons and labour camps, we suspected that other mechanisms may have overshadowed the expected effect. Evidence in support of this assertion was obtained from a model restricted to those who survived repression. The model revealed a positive association between the duration of captivity (a proxy for repression-related hardship) and the mortality risk after release. The scarring effect of repression was also evident in the results based on a model that interacted mortality risk with calendar periods. The excess risk associated with the delayed influence of repression emerged several decades after exposure, during the 1970s to mid-1990s. Thus, the answer to our second research question turned out to be positive.

Failure to detect a prevailing long-term scarring effect of imprisonment on the group of survivors is not exceptional in empirical research (Roelfs et al. 2010; Costa 2012; Sagi-Schwartz et al. 2013). The authors of previous studies have proposed several explanations for the lack of such an effect, including a post-traumatic increase in resiliency, institutional support to survivors, and selection based on the survival of the hardiest. The disappearance of the scarring effect in the final period of observation, starting from the mid-1990s, is indicative of cohort inversion. This may be due to selective mortality, but the contribution of other mechanisms – resilience and increased institutional support to survivors as of the 1990s – cannot be dismissed. It is notable that all of these mechanisms work in the same direction, but data limitations do not allow us to distinguish their relative roles.

The change in the pattern compared with the previous period (1970–1994) supports the notion that the scarring mechanism may operate in tandem with others mechanisms, such as selection, in shaping the survival outcomes of those who experienced repression, and the prevailing mechanism may change from one period to another. Among our study population, the scarring effect seems to have prevailed during earlier periods, giving way to the effect of other mechanisms causing cohort inversion at a later stage.

Comparing the volunteers who escaped to the West with their counterparts who lived in Estonia (including several decades under the Soviet regime) supplied the answer to our third research question concerning the influence of the societal context. In line with

our expectations, the results revealed a persistent disparity associated with country of residence. As shown by the interaction model, the dynamics of the survival disadvantage of the volunteers who lived in Estonia exhibit a pattern that closely resembles the East–West mortality difference (Meslé and Vallin 2017). Excluding the first post-war decade, which was marked by unusual hardship in Estonia, the gap in mortality risks associated with the societal context was relatively small in the late 1950s and the 1960s but increased noticeably from the 1970s to the early 1990s. Since the mid-1990s, the gap has gradually diminished, although it has not entirely disappeared. The group that had been subjected to repression and whose outcomes had contributed to the disparity in mortality risks began to contribute to narrowing the gap during the final period. We see this as additional evidence that the scarring effect was overshadowed by selection in later life.

With regard to how closely our findings match the results of follow-up studies on war-related adversities in Western countries, our subgroups and analysis can best be compared with research on prisoners of war and concentration camp survivors. Although circumstances differed and their imprisonment extended well into the post-war years, our findings on Estonian volunteers to the Finnish Army notably corroborate results reported for similar groups in Western countries. On the one hand, we found evidence of increased mortality risks among men who were subjected to repression. This finding is in line with a number of studies on prisoners of war (Dent et al. 1989; Page and Ostfeld 1994; Gale et al. 1999; Page and Brass 2001; Solomon et al. 2014) and concentration camp survivors (Eitinger 1973; Keinan-Boker et al. 2009). On the other hand, the disappearance of a scarring effect towards the end of the observation period is similar to the decrease in excess mortality among US military personnel taken captive during WWII (Nefzger 1970; Keehn 1980). The lack of a detectable mortality disadvantage in the main effects model pertaining to volunteers who survived repression corroborates several studies of Holocaust survivors (Stessman et al. 2008; Sagi-Schwartz et al. 2013; Fund et al. 2019). The overall similarity of the findings evidently stems from common underlying mechanisms briefly outlined in the theoretical section of the article.

We are nonetheless aware that our study has important limitations. First of all, the information extracted from the individual biographies of the volunteers is not sufficiently detailed to allow for the reconstruction of full life histories (childhood, employment career, partnership dynamics, etc.), which can be relevant to mortality risks in adulthood. Furthermore, we lack information on post-war health status and behaviours (smoking, alcohol consumption, dietary habits, etc.) that entail risk factors for a variety of diseases. The subgroup that fled to the West may also have had more resources that facilitated their escape from Estonia. As our models do not wholly control for this possibility, selection based on resources may have contributed to a survival advantage for the latter group but is not likely to have produced it. In addition, our outcome measures are limited to mortality from all causes. Due to these limitations, we are unable to elaborate on the



pathways by which the scarring effects of adversity and the societal context operate. Our study population of volunteers is select, which prevents direct generalisation of the results – especially the quantitative – to the wider population. However, there are several strengths, such as the prospective design and completeness of the follow-up, that counterbalance these limitations. This has allowed us to track the study population almost exhaustively, with a very small proportion of survivors remaining, most of whom are well over 90 years old. In addition, our outcome measure is simple and objective, devoid of response or interpretation error.

In summary, there are two main conclusions that can be drawn from our study. From the substantive perspective, the results lend support to the view that the sequelae of war-related repression affect the surviving population for many decades. From the methodological point of view, our findings suggest that the scarring effects of adversity may remain undetected in the presence of other mechanisms, such as selection based on differential mortality. Reliance on main-effects models that compare the survival outcomes of groups of individuals that have or have not been exposed to adversity may increase the possibility of non-detection. In order to reduce that risk, two analytical approaches proved helpful in this study. The first restricted the analysis to individuals exposed to adversity and focussed on the association between survival and the severity of exposure. The second approach interacted the time elapsed since exposure with subgroup affiliation. This revealed a complex transformation of the pattern, whereby the dominant mechanism was supplanted by another. We trust that these approaches might be useful in situations where cohort inversion overshadows the scarring effect of adversity.

## **7. Acknowledgements**

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### **Corrections:**

On November 17, 2020, minor updates to the data values in Table 1 were made at the authors' request.

## References

- Alexopoulos, G. (2017). *Illness and Inhumanity in Stalin's Gulag*. New Haven: Yale University Press. doi:10.12987/yale/9780300179415.001.0001.
- Anderson, B.A. and Silver, B.D. (1989). Patterns of cohort mortality in the Soviet population. *Population and Development Review* 15(3): 471–501. doi:10.2307/1972443.
- Applebaum, A. (2003). *Gulag: A history*. New York: Doubleday.
- Bedard, K. and Deschênes, O. (2006). The long-term impact of military service on health. Evidence from World War II and Korean War veterans. *American Economic Review* 96(1): 176–194. doi:10.1257/000282806776157731.
- Boehmer, T.K., Flanders, W.D., McGeehin, M.A., Boyle, C., and Barrett, D.H. (2004). Postservice mortality in Vietnam veterans: 30-year follow-up. *Archives of Internal Medicine* 164(17): 1908–1916. doi:10.1001/archinte.164.17.1908.
- Boscarino, J.A. (2006). Posttraumatic stress disorder and mortality among U.S. army veterans 30 years after military service. *Annals of Epidemiology* 16(4): 248–256. doi:10.1016/j.annepidem.2005.03.009.
- Bramsen, I., Deeg, D.J.H., Van der Ploeg, E., and Fransman, S. (2007). Wartime stressors and mental health symptoms as predictors of late-life mortality in World War II survivors. *Journal of Affective Disorders* 103(1): 121–129. doi:10.1016/j.jad.2007.01.014.
- Collins, C., Burazeri, G., Gofin, J., and Kark, J. D. (2004). Health status and mortality in Holocaust survivors living in Jerusalem 40–50 years later. *Journal of Traumatic Stress* 17(5): 403–411. doi:10.1023/B:JOTS.0000048953.27980.18.
- Costa, D.L. (2012). Scarring and mortality selection among civil war POWs: A long-term mortality, morbidity, and socioeconomic follow-up. *Demography* 49(4): 1185–1206. doi:10.1007/s13524-012-0125-9.
- Den Velde, W.O., Deeg, D.J.H., Hovens, J.E., Van Duijn, M.A.J., and Aarts, P.G.H. (2011). War stress and late-life mortality in World War II male civilian resistance veterans. *Psychological Reports* 108(2): 437–448. doi:10.2466/02.10.16.PR0.108.2.437-448.
- Dent, O.F., Richardson, B., Wilson, S., Goulston, K.J., and Murdoch, C.W. (1989). Postwar mortality among Australian World War II prisoners of the Japanese. *The*

*Medical Journal of Australia*. 150 (7): 378–382. doi:10.5694/j.1326-5377.1989.tb136529.x.

- Eitinger, L.A. (1973). Follow-up study of the Norwegian concentration camp survivors' mortality and morbidity. *Israel Annals of Psychiatry and Related Disciplines* 11(3): 199–209.
- Elder, G.H., Clipp, E.C., Brown, J.S., Martin, L.R., and Friedman, H.S. (2009). The lifelong mortality risks of World War II experiences. *Research on Aging* 31(4): 391–412. doi:10.1177/0164027509333447.
- Feder, A., Southwick, S.M., Goetz, R.R., Wang, Y., Alonso, A., Smith, B.W., Buchholz, K.R., Waldeck, T., Ameli, R., Moore, J., Hain, R., Charney, D.S., and Vythilingam, M. (2008). Posttraumatic growth in former Vietnam prisoners of war. *Psychiatry* 71(4): 359–370. doi:10.1521/psyc.2008.71.4.359.
- Field, M.G. (1995). The health crisis in the former Soviet Union: A report from the 'post-war' zone. *Social Science and Medicine* 41(11): 1469–1478. doi:10.1016/0277-9536(95)00060-K.
- Fund, N., Ash, N., Porath, A., Shalev, V., and Koren, G. (2019). Comparison of mortality and comorbidity rates between Holocaust survivors and individuals in the general population in Israel. *JAMA Network Open* 2(1). doi:10.1001/jamanetworkopen.2018.6643.
- Gale, C.R., Braidwood, E.A., Winter, P.D., and Martyn, C.N. (1999). Mortality from Parkinson's disease and other causes in men who were prisoners of war in the Far East. *Lancet* 354(9196): 2116–2118. doi:10.1016/S0140-6736(99)06264-9.
- Hearst, N., Newman, T.B., and Hulley, S.B. (1986). Delayed effects of the military draft on mortality. A randomized natural experiment. *The New England Journal of Medicine* 314(10): 620–624. doi:10.1056/NEJM198603063141005.
- Hertzman, C., Kelly, S., and Bobak, M. (eds.) (1996). *East-west life expectancy gap in Europe: Environmental and non-environmental determinants*. Dordrecht: Kluwer Academic Publishers.
- Hines, L.A., Sundin, J., Rona, R.J., Wessely, S., Fear, N.T. (2014). Posttraumatic stress disorder post Iraq and Afghanistan: Prevalence among military subgroups. *The Canadian Journal of Psychiatry* 59(9): 468–479. doi:10.1177/070674371405900903.
- Hobcraft, J., Menken, J., and Preston, S. (1982). Age, period, and cohort effects in demography: A review. *Population Index* 48 (1): 4–43. doi:10.2307/2736356.

- Horiuchi, S. (1983). The long-term impact of war on mortality: Old-age mortality of the First World War survivors in the Federal Republic of Germany. *Population Bulletin of the United Nations* 15(15): 80–92.
- Ivanova, G.M., Raleigh, D.J., Mikhailovna, G., and Flath, C.A. (2015). *Labor camp socialism: The Gulag in the Soviet totalitarian system*. New York: Routledge. doi:10.4324/9781315703039.
- Jowett, P. and Snodgrass, B. (2006). *Finland at war 1939–45*. Oxford: Osprey Publishing.
- Katus, K. (2000). Long-term mortality trend in the Baltic countries. *Trames Journal of the Humanities and Social Sciences* 4(3): 231–256.
- Keehn, R.J. (1980). Follow-up studies of World War II and Korean conflict prisoners. III. Mortality to January 1, 1976. *American Journal of Epidemiology* 111(2): 194–211. doi:10.1093/oxfordjournals.aje.a112887.
- Keinan-Boker, L., Vin-Raviv, N., Liphshitz, I., Linn, S., and Barchana, M. (2009). Cancer incidence in Israeli Jewish survivors of World War II. *Journal of National Cancer Institute* 101(21): 1489–1500. doi:10.1093/jnci/djp327.
- Kumer-Haukanõmm, K., Rosenberg, T., and Tammaru, T. (eds.). (2006). *Suur põgenemine 1944. Eestlaste lahkumine läände ja selle mõjud* [The great escape 1944. The departure of Estonians to the West and its impact]. Tartu: Tartu Ülikooli Kirjastus.
- Kuutma, R. (ed.) (1997). *Vabaduse eest: soomepoiste lühielulood* [For freedom: Short biographies of Estonian volunteers in the Finnish Army]. Tallinn: Soome Sõjaveteranide Eesti Ühendus.
- Kuutma, R. (2004). *Kolmas tee: Eesti auks, tuleviku pandiks* [The third way: In honor of Estonia, a pledge for the future]. Tallinn: Olion.
- Laar, M., Pillak, P., Rebas, H., and Saueaak, M. (2010). *Soomepoisid – võitlus jätkub. II maailmasõjas Soome armees võidelnud Eesti vabatahtlike ajalugu 1939–2010* [The fight continues. The history of Estonian volunteers in the Finnish Army 1939–2010]. Tallinn: Grenader.
- Mark, K.M., Stevelink, S.A.M., Choi, J., and Fear, N.T. (2018). Post-traumatic growth in the military: A systematic review. *Occupational and Environmental Medicine* 75(12): 904–915. doi:10.1136/oemed-2018-105166.

- Meslé, F. and Vallin, J. (2017). The end of East–West divergence in European life expectancies? An introduction to the special issue. *European Journal of Population* 33(5): 615–627. doi:10.1007/s10680-017-9452-2
- Mitchell, M.M., Gallaway, M.S., Millikan, A.M., and Bell, M.R. (2013). Combat exposure, unit cohesion, and demographic characteristics of soldiers reporting posttraumatic growth. *Journal of Loss and Trauma* 18(5): 383–395. doi:10.1080/15325024.2013.768847.
- Nefzger, M.D. (1970). Follow-up studies of World War II and Korean War prisoners: 1. Study plan and mortality findings. *American Journal of Epidemiology* 91(2): 123–138. doi:10.1093/oxfordjournals.aje.a121120.
- Õispuu, L. (ed.). (1996). *Political arrests in Estonia 1940–1988* (§58). Tallinn: Estonian Repressed Persons Records Bureau; Estonian Archives Department; Estonian State Computing Centre; Information and History Committee of the Estonian Association of Illegally Repressed Persons MEMENTO.
- Õispuu, L. (ed.). (1998). *Political arrests in Estonia under Soviet occupation 1940–1988*. Tallinn: Estonian Repressed Persons Records Bureau; Estonian State Archives; Estonian State Computing Centre; Tallinn Technical University; Estonian Association of Illegally Repressed Persons MEMENTO.
- Õispuu, L. (ed.). (2005). *Political arrests in Estonia under Soviet occupation 1940–1988*. Tallinn: The Estonian Ministry of Justice; Estonian Repressed Persons Records Bureau; The State Archives of Estonia; Tallinn Technical University; Estonian Association of Illegally Repressed Persons MEMENTO.
- Okubo, M. (1981). *Increase in mortality of middle-aged males in Japan*. Tokyo: Nihon University Population Research Institute.
- Olsen, M.H., Nielsen, H., Dalton, S.O., and Johansen, C. (2015). Cancer incidence and mortality among members of the Danish resistance movement deported to German concentration camps: 65-Year follow-up. *International Journal of Cancer* 136(10): 2476–2480. doi:10.1002/ijc.29288.
- Page, W.F. and Brass, L.M. (2001). Long-term heart disease and stroke mortality among former American prisoners of war of World War II and the Korean conflict: Results of a 50-year follow-up. *Military Medicine* 166(9): 803–808. doi:10.1093/milmed/166.9.803.
- Page, W.F. and Ostfeld, A.M. (1994). Malnutrition and subsequent ischemic heart disease in former prisoners of war of World War II and Korean conflict. *Journal of Clinical Epidemiology* 47(12): 1437–1441. doi:10.1016/0895-4356(94)90087-6.

- Pillak, P. and Vilbiks, H. (eds.). (2015). *Soomepoiste elulood. Soome sõjaväes II maailmasõja aastatel teeninud eestlased ja Eesti vabatahtlikud* [Biographies of Estonians and Estonian volunteers who served in the Finnish Army during WWII]. Tallinn: Grenader.
- Relvik, H. (2003). *Mereväe soomepoisid* [Estonian volunteers in the Finnish Navy]. Tallinn: Soome Mereväes Teeninud Eestlaste Gild.
- Roelfs, D., Shor, E., Davidson, K., and Schwartz, J. (2010). War-related stress exposure and mortality: A meta-analysis. *International Journal of Epidemiology* 39(6): 1499–1509. doi:10.1093/ije/dyq132.
- Saarela, J. and Finnäs, F. (2012). Long-term mortality of war cohorts. The case of Finland. *European Journal of Population* 28(1): 1–15. doi:10.1007/s10680-011-9246-x.
- Sagi-Schwartz, A., Bakermans-Kranenburg, M.J., Linn, S., and van IJzendoorn, M.H. (2013). Against all odds: Genocidal trauma is associated with longer life-expectancy of the survivors. *PLoS One* 8(7): 1–6. doi:10.1371/journal.pone.0069179.
- Saueauk, M. (2010). Soomepoisid raudeesriide taga Nõukogude võimu all [Estonian volunteers behind the Iron Curtain under Soviet rule]. In: Laar, M., Pillak, P., Rebas, H., and Saueauk, M. (eds.). *Soomepoisid – võitlus jätkub. II maailmasõjas Soome armees võidelnud Eesti vabatahtlike ajalugu 1939–2010* [Finnish boys – the fight continues. History of Estonian volunteers who fought in the Finnish Army in World War II 1939–2010]. Tallinn: Grenader
- Shearer, D.R. (2009). *Policing Stalin's Socialism: Repression and Social Order in the Soviet Union, 1924–1953*. New Haven: Yale University Press.
- Solomon, Z., Greene, T., Ein-Dor, T., Zerach, G., Benyamini, Y., and Ohry, A. (2014). The long-term implications of war captivity for mortality and health. *Journal of Behavioral Medicine* 37(5): 849–859. doi:10.1007/s10865-013-9544-3.
- Staugaard, S.R., Johannessen, K.B., Thomsen, Y.D., Bertelsen, M., and Berntsen, D. (2015). Centrality of positive and negative deployment memories predicts posttraumatic growth in Danish veterans. *Journal of Clinical Psychology* 71(4): 362–377. doi:10.1002/jclp.22142.
- Stessman, J., Cohen, A., Hammermann-Rozenberg, R., Bursztyn, R., Azoulay, D., Maaravi, Y., and Jacobs, J.M. (2008). Holocaust survivors in old age: The Jerusalem longitudinal study. *Journal of American Geriatric Society* 56(9): 470–477. doi:10.1111/j.1532-5415.2007.01575.x.

- Uustalu, E. (1977). *For freedom only: The story of Estonian volunteers in the Finnish wars of 1940–1944*. Toronto: Northern Publications.
- Uustalu, E. and Moora, R. (1993). *Soomepoisid. Ülevaade Eesti vabatahtlike liikumisest ja sõjateest Soomes ja kodumaal Teise maailmasõja päevil* [An overview of the Estonian volunteer movement and war experience in Finland and Estonia during WWII]. Tallinn: Olion.
- Vallin, J., Jasilionis, D., and Meslé, F. (2017). Does a turbulent history lead to turbulent life expectancy trends? Evidence from the Baltic countries. *Historical Methods: A Journal of Quantitative and Interdisciplinary History* 50(4): 191–209. [doi.10.1080/01615440.2017.1338977](https://doi.org/10.1080/01615440.2017.1338977).
- Zarulli, V. (2013). The effect of mortality shocks on the age-pattern of adult mortality. *Population. English Edition* 68(2): 265–292. [doi:10.3917/pope.1302.0265](https://doi.org/10.3917/pope.1302.0265).

