Historical Development and Persistence of the Sex Gap in Life Expectancy in Estonia From the 19th to the 21st Century

By Mark Gortfelder

To cite this article: Gortfelder, M. (2026). Historical Development and Persistence of the Sex Gap in Life Expectancy in Estonia From the 19th to the 21st Century. *Historical Life Course Studies, 16*, 290–306. https://doi.org/10.52024/hlcs25298

HISTORICAL LIFE COURSE STUDIES

VOLUME 16

2026

EHPS NETWORK

MISSION STATEMENT

HISTORICAL LIFE COURSE STUDIES

Historical Life Course Studies was established within *European Historical Population Samples Network* (EHPS-Net). The journal is the primary publishing outlet for research involved in the conversion of existing European and non-European large historical demographic databases into a common format, the Intermediate Data Structure, and for studies based on these databases. The journal publishes both methodological and substantive research articles.

Methodological Articles
This section includes methodological articles that describe all forms of data handling involving large historical databases, including extensive descriptions of new or existing databases, syntax, algorithms and extraction programs. Authors are encouraged to share their syntaxes, applications and other forms of software presented in their article, if pertinent.

Research articles
This section includes substantive articles reporting the results of comparative longitudinal studies that are demographic and historical in nature, and that are based on micro-data from large historical databases.

Historical Life Course Studies is a no-fee double-blind, peer-reviewed open-access journal supported by the European Science Foundation, the International Institute of Social History, the European Society of Historical Demography, Radboud University Press, Lund University and HiDO Scientific Research Network Historical Demography. Manuscripts are reviewed by the editors, members of the editorial and scientific boards, and by external reviewers. All journal content is freely available on the internet at hlcs.nl.

European Science Foundation
international institute of social history
ESHD European Society of Historical Demography
Radboud University Nijmegen, the Netherlands
open journals.nl
HiDo Network for Historical Demography
Lund University
KNAW

HISTORICAL LIFE COURSE STUDIES
VOLUME 16 (2026), 290–306, published 23-07-2026

Historical Development and Persistence of the Sex Gap in Life Expectancy in Estonia From the 19th to the 21st Century

Mark Gortfelder

Tallinn University, Estonia

ABSTRACT

The pronounced male disadvantage in life expectancy in Eastern Europe since the 1970s is a well-established finding in mortality research. However, a longer-term perspective has been largely absent, despite extensive documentation of changes in the sex gap in life expectancy across several Western European countries. The first objective of this paper is to examine the evolution of the sex gap in life expectancy in Estonia from the 19th century onward and compare it to other European nations. The second aim is to analyse the contributions of age- and cause-specific mortality and their interaction using Arriaga decomposition. The results show that since the 19th century, life expectancy at birth for Estonian men has consistently been at least 10% lower than that of women, albeit with some temporal variation. This means that the sex gap in Estonia has remained wider than in Western European countries throughout this time and not merely since the 1970s. The age and cause of death contributions have shifted in line with the health transition. Notable divergences from Western European patterns reflect Estonia's distinct socio-political trajectory.

Keywords: Life expectancy, Mortality, Sex differences, Estonia, Eastern Europe, Decomposition

e-ISSN: 2352-6343
DOI article: https://doi.org/10.52024/hlcs25298

1 INTRODUCTION

The large life expectancy gap between men and women that emerged during the late socialist and early post-socialist periods in Eastern European countries is well documented in the scholarly literature (Aburto & van Raalte, 2018; Jasilionis et al., 2011; Leon, 2011; Meslé, 2004; Meslé & Vallin, 2017; Shkolnikov et al., 2006; Stickley et al., 2007; Trias-Llimós et al., 2018). Several factors have contributed to this phenomenon. First, socialist societies were largely unable to benefit from the cardiovascular revolution, and because cardiovascular mortality was more prevalent among men, this contributed to the widening life expectancy gap between the sexes. More broadly, the economic difficulties of the late socialist and early post-socialist periods disproportionately affected men, who were more often the primary breadwinners and were overrepresented in the sectors most severely impacted by economic restructuring. In addition, alcoholism and alcohol-related accidents, which are both more common among men, may be interpreted as manifestations of broader psychological and social problems related to stress, insecurity, and coping mechanisms.

Long-term development of the sex gap in life expectancy has been studied in several Western European countries. However, there is lack of research addressing the disparity in Eastern Europe before the 1960s. The book edited by Dinges and Weigl (2016b) has contributions from several different authors for Germany, Austria, Switzerland, Britain, Sweden, Belgium and the Netherlands. However, the contributions vary substantially on how they have approached the question, partly also due to unavoidable reasons relating to the existence of statistical data for the earlier period (Dinges & Weigl, 2016a, p. 187). The analysis presented here most resembles the articles on Belgium (Deboosere, 2016), the Netherlands (van Poppel & Janssen, 2016) and Switzerland (Kohli, 2016) from the aforementioned volume, since they all use decomposition analysis. This method has also been used by Maiolo and her co-authors, who have studied the life expectancy sex gap for England and Wales and Norway (2020; 2023).

These works show how the sex gap has evolved during the various stages of the health transition (Vallin & Meslé, 2004), but also discussed the wider societal changes, and how these affected the sex disparity, as well as its the country-specific aspects (see Dinges & Weigl, 2016a).

Previous literature has shown that before 1900, the largest contribution to the life expectancy sex gap came from infant mortality, which remained high during the early phase of the demographic transition. However, there was considerable variation between countries in both the level and evolution of the sex gap in life expectancy. For example, in Sweden, the disparity was already large in the late 18th century and increased further during the first half of the 19th century, reaching approximately 10% in proportional terms, before narrowing thereafter. In contrast, in mid-19th-century Belgium there were even years when life expectancy at birth was lower for women than for men. These diverging patterns can be explained by country-specific socioeconomic circumstances. (Deboosere, 2016; Willner, 2016).

From the 1870s onward, coinciding with industrialisation and urbanisation, the sex disparity increased in most countries for which data are available. The widening of the sex gap in the decades preceding the First World War was driven by diverging mortality patterns in adulthood, with men facing a greater burden due to their higher employment in hazardous occupations and higher prevalence of risky behaviours, particularly alcohol-related mortality. The increase in adult male mortality was sufficiently strong to widen the life expectancy gap at birth despite the simultaneous decline in infant mortality, which itself exhibited a substantial male disadvantage.

The difference in life expectancy between the sexes continued to widen in Europe during the interwar period. However, this trend was also observed in neutral and non-occupied countries, making it difficult to attribute it primarily to the long-term effects of frontline combat.

The spread of antibiotics after the Second World War contributed to a decline in post-partum mortality. At the same time, differences in smoking prevalence between men and women became an important factor underlying the sex gap in longevity. Smoking is considered as one of the main reasons why the sex gap in life expectancy reached a maximum during the post-war decades (Dinges & Weigl, 2016a). After the late 1970s, the sex gap in life expectancy began to narrow in Western Europe, in contrast to the trends in Eastern Europe.

This article focuses on Estonia. Estonian mortality development in the late socialist and early post-socialist era has been extensively studied, also noting the widening of the sex difference (Baburin et al., 2011; Jasilionis et al., 2011; Leinsalu et al., 2003, 2004; Leinsalu & Rahu, 1993; Rahu et al., 2019;

Sakkeus & Karelson, 2008). A few papers focusing on Estonia or the Baltic states together have also addressed long-term developments in mortality and life expectancy (Katus, 2000; Katus & Puur, 1991; Vallin et al., 2017). However, none of these studies specifically focus on the contributions of age- and cause-specific mortality to the sex gap in life expectancy in the long-term.

This paper aims to fill this gap. First, it provides a descriptive overview of the historical development of the relative sex difference in life expectancy at birth in Estonia since the 19th century from a comparative perspective. Second, it uses decomposition analysis to examine the contributions of age- and cause of death to the sex gap during census years. Wherever possible, comparisons are made with other countries for which similar studies have been published. Finally, the findings are linked to broader sociopolitical developments, or what Vallin et al. (2017) call the "turbulent history" of Estonia.

We note that the existence of a sex gap in longevity is to a some extent natural due to various biological mechanisms that contribute to higher mortality in men (Luy, 2016; Oksuzyan et al., 2019). Here, we take a comparative perspective and contrast the Estonian sex disparity and its components with those of other countries. We assume that the biological component does not vary substantially across societies and therefore interpret comparatively large sex gaps primarily as the result of social factors.

2 DATA AND METHOD

2.1 LIFE TABLES

This analysis is primarily based on life tables. The sociopolitical environment and its changes in Estonia have influenced not only mortality trends but also the collection and preservation of the demographic data required to construct life tables (i.e., population composition and death counts by age and sex). As a result, the availability of data for constructing life tables in Estonia is considerably poorer than in most Western European countries, particularly for the period before the 1920s, when Estonia was under Tsarist rule, as well as during the Second World War and the immediate postwar years (Puur et al., 2005; Vallin et al., 2017). We emphasise that the main issue concerns establishing the population age structure, primarily due to unregistered migration rather than deficiencies in vital registration, which are comparatively easier to account for. Consequently, the main decomposition analysis is conducted for census years in order to ensure the highest possible quality of the life tables.

The earliest national life table for Estonia exists for the years of 1896–1897 (Katus & Puur, 1991). Little hope exists on having country-level mortality estimates from earlier decades. Instead, we will use life tables that have been computed for smaller areas (Jaadla et al., 2017; Klesment & Lust, 2021a). Also, we will use the method of McCann (1976) to compute the life expectancy at birth from crude birth and death rates that require less detailed data. This is done for the governate of Estland (encompassing roughly modern-day North Estonia), for the tax census years of 1834, 1850 and 1858 using the data compiled by Vahtre (1973). The same estimation can also be done with the data compiled by Laarmaa (2009) for Tartu county in Southern Estonia based on the local census conducted in 1881.

For the interwar independence period we have yearly life tables from 1922 to 1938 (Katus & Puur, 2004). The start of the first Soviet occupation in 1940 brought about a break in the statistical system and relevant time-series (Puur et al., 2005). For 1950–1958 lifetables are provided by Katus and Puur (2004). From 1959 onwards the data comes from either the Human Mortality Database (2024) or for the years 2020–2023 Statistics Estonia (2024).

In addition to the above-mentioned life tables, we computed a new life table for Estonia for the year 1948. The motivation was to obtain an estimate for the immediate post-WWII period. Given the focus on the sex gap, these data are of particular interest, as the postwar years were characterised by extensive political violence (Kaasik et al., 2009; Saueauk, 2015; Saueauk & Hiio, 2018) and armed resistance against the Soviet authorities (Laar, 2013), both of which as well as war-related scarring and injuries impacted men more than women. The key problem again is the lack of information on population structure.[1]

1 Death counts by age and sex are taken from official statistics, table RV493 in the database of Statistics Estonia (2024).

We rely on a nonstandard data source — the lists of eligible voters prepared by local authorities for the local elections in 1948 (Puur & Uuet, 2010). Similar lists exist for other years, as elections were held frequently in the Soviet Union, although all candidates represented the Communist Party. These lists were also used by contemporary statisticians to produce annual population estimates by correcting for undercounting (for example, excluding individuals without voting rights) and other sources of error, such as migration and deaths. In 1948, in addition to the voter lists, which naturally covered only the adult population, a census of juveniles was conducted with the specific aim of obtaining information on the total population. The information on juveniles was then combined with that on the adult population to produce complete population counts (Puur & Uuet, 2010).

However, it should be noted that these data capture only the legal population with Soviet passports. Individuals hiding from the occupation authorities were excluded, and these were predominantly men of military age. This issue also affects the recorded number of deaths. We are unable to assess precisely the magnitude of the resulting bias in the life table estimates, as data on both the age-sex composition of the hidden population and their mortality are lacking. The issue of the undocumented population is particularly relevant for this paper because the quality problems affect the two sexes differently. For most other years, data-quality issues can be expected to affect men and women in a broadly similar manner. In 1948, however, the bias is skewed toward men.

Life table estimates for other countries are taken from the Human Mortality and Life-Table Databases. For Latvia and Lithuania, life tables computed by Norkus et al. (2022) are included for the interwar period. Since we focus on long-term trends, we compare Estonia to countries which have sufficiently long time series.

Table 1 *Data sources used*

Unit	Year(s)	Life tables	Cause of death	Notes
Tartu (town)	1881–1882	Jaadla et al. (2017)		Lutherans only
Mulgimaa (manors)	1834–1891	Klesment & Lust (2021a)		
Estland (gouvernate)	1834, 1850, 1858	McCann's (1976) indirect method		Population and death counts: Vahtre (1973)
Tartumaa (rural county)	1881	McCann's (1976) indirect method		Deaths from Laarmaa (2009), population from census
Estonia	1896–1897	Katus & Puur (1991)		
	1922–1938	Katus & Puur (2004)	Unpublished statistics in the National Archive (ERA.1831.1.606)	Cause of death for 1934 only
	1948	Self-computed. Population counts from Puur and Uuet (2010); Death counts from Statistics Estonia (2024)	Unpublished archival material gathered by Katus	
	1950–1958	Katus & Puur (2004)		
	1959–2020	Human Mortality Database (2024)	Human Cause-of-Death Database (2024)	2021–2023 Statistics Estonia (2024)
Latvia, Lithuania	1925–1939	Norkus et al. (2022)		
Other countries	1896–2021	Human Mortality Database (2024); Human Life-Table Database (2024)		

2.2 DATA ON CAUSE OF DEATH

Causes of death were recorded in Estonia in parish death registers by the clergy from the 18th century onward, although this only became mandatory in 1834. Unfortunately, the information was neither centrally collected nor based on a classification system, and the medical knowledge of clergymen was limited and uneven (Rootsmäe, 1987).

Cause of death registration improved considerably after independence in 1918. In 1926, a modern statistical system for the registration of vital events was introduced. The new individual death records included information on the cause of death, which had to be recorded according to international classifications (Pullerits & Rammul, 1925, 1931, 1935). However, causes of death were reported by physicians only in urban municipalities; in rural areas, this information was still provided by the family of the deceased. For 1933, we know that the cause of death was determined by a physician for only 39% of deaths (Rumma, 1935). It is difficult to determine when certification by physicians or other medical personnel became mandatory, as statistics and metadata were state secrets in the Soviet Union. From 1963 onward, every death certificate had to be accompanied by a medical death certificate.

The cause of death data used in this paper relies primarily again on the relevant international databases. First, we take data (death counts) from the Human Cause-of-Death Database (2024), which has data on Estonia for the years 1955–2019.[2] Our analysis is based on the census years of 1959, 1970, 1979, 1989, 2000 and 2011. Since for most years, the data source is the Human Cause-of-Death Database, we have used its "short list" as the primary classification (based on ICD-10), although we have reduced the number of categories to nine (infectious, neoplasms, nervous system, circulatory system, respiratory system, digestive system, external, other, unknown). Since the Soviet Union did not use the international classification of disease, it is impossible to fully harmonise it (see metadata in the Human Cause-of-Death Database (2024)). For the census years of 2021, we use data from Statistics Estonia, which is given in ICD-10.

For the interwar period, we use cause of death data for the census year 1934. These data are drawn from unpublished archival materials of the statistical authorities and employ the "short-list" cause of death groups of the international classification system used at the time. Consequently, we are unable to reclassify individual causes to harmonise them fully with later classifications. For 1948, we use unpublished archival data collected by Kalev Katus, based on the Soviet classification system in use at the time. For both 1934 and 1948, full harmonisation with the classification employed by the Human Cause-of-Death Database is impossible; however, given the use of broad cause of death categories, the classifications should be reasonably comparable. It should also be noted that the quality of cause of death statistics at the time was limited, and we are unable to improve the original data (for discussion on this see for instance Maiolo and Reid (2020); Reid et al. (2015)).

2.3 METHOD

This study first takes a descriptive view of the evolution on the sex gap in life expectancy in Estonia and other countries from the end of the 19th century.

As noted, we compute life expectancy at birth indirectly also using the method developed by McCann (1976). This method allows to use only information on crude birth and death rates (as opposed to age-specific population and death counts as with life tables) combined with a correction factor based on model stable populations. Torres (2020) shows for Nordic countries that the indirect estimation is close to life table estimates until the beginning of the 20th century when mortality has declined considerably compared to pre-transitional levels.

The bulk of the study focuses on the contributions of age, cause of death and the combination of the two on the sex gap in life expectancy in Estonia. This is done with a decomposition method developed

2 The public data in the Human Cause-of-Death Database has been reconstructed by allocating unknown and ill-defined cases proportionally to other groups. For this article, this data has not been used. Rather, by personal communication, data was gathered from the Human Cause-of-Death Database, which would have the unknown and ill-defined separately. This has been done, since for the years 1934 and 1948, unknown and ill-defined causes of death make up a high proportion of all deaths, and it would not be the best action to allocate them proportionally among other causes (Janssen & Kunst, 2004, p. 911). Additionally, other similar studies with which we make comparisons have listed these groups separately.

by Arriaga (1984). The method breaks down differences in life expectancy between two populations (or periods) into age-specific contributions, showing how much mortality differences at each age group add to or subtract from the overall gap. It separates the direct effect of mortality change within an age group from the indirect and interaction effects operating through survival to older ages, allowing researchers to quantify the relative importance of mortality at different ages.

3 RESULTS

3.1 TREND IN THE SEX GAP IN LIFE EXPECTANCY

As noted, the first national-level life table for Estonia covers the years 1896–1897. To extend the historical perspective, we begin this section by using subnational life expectancy estimates from earlier periods to trace the evolution of sex differences in life expectancy in Estonia.

In 1881–1882, the life expectancy among the Lutheran population in Tartu was 15% shorter for men than women (Jaadla et al. 2017).[3] Among the rural family reconstruction population of Holstre in southern Estonia (Klesment & Lust, 2021a) the sex gap in longevity was 10% between 1834 and 1853. In the period from 1874 to 1891, the gap widened to 15%. However, these estimates are not easily generalisable to reflect differences across the entire country.

Applying McCann's indirect method (1976) to estimate life expectancy at birth for the governate of Estland (which includes present-day North Estonia) in 1834, 1850, and 1858 yields estimates of the male disadvantage of 8%, 4%, and 8%, respectively. In 1881 in Tartu County, Southern Estonia, the sex gap was also 8%.

Comparing the sex gap from these subnational estimates to the national-level data of other countries (Dinges & Weigl, 2016b), it can be said that the gap in proportional terms was bigger than in most other countries for which this data exists. With the exceptions of Iceland and Sweden, no country had a gap that exceeded 10%.

Figure 1 presents the sex gap in life expectancy for Estonia and 34 other countries, with Estonia and five of its closest neighbours highlighted. The sex gap is expressed in relative terms, which is more appropriate for long-term comparisons given the substantial increase in longevity over time, making the use of absolute differences less suitable. Note also that data for the years of the First and Second World Wars are not shown.[4]

By the end of the 19th century, Estonia already exhibited a relatively large sex difference in longevity, with men living on average 8.5% shorter lives than women. This disparity was greater than in most other countries, with the exception of Iceland, which "led" in this respect during most years of the 19th and early 20th centuries.

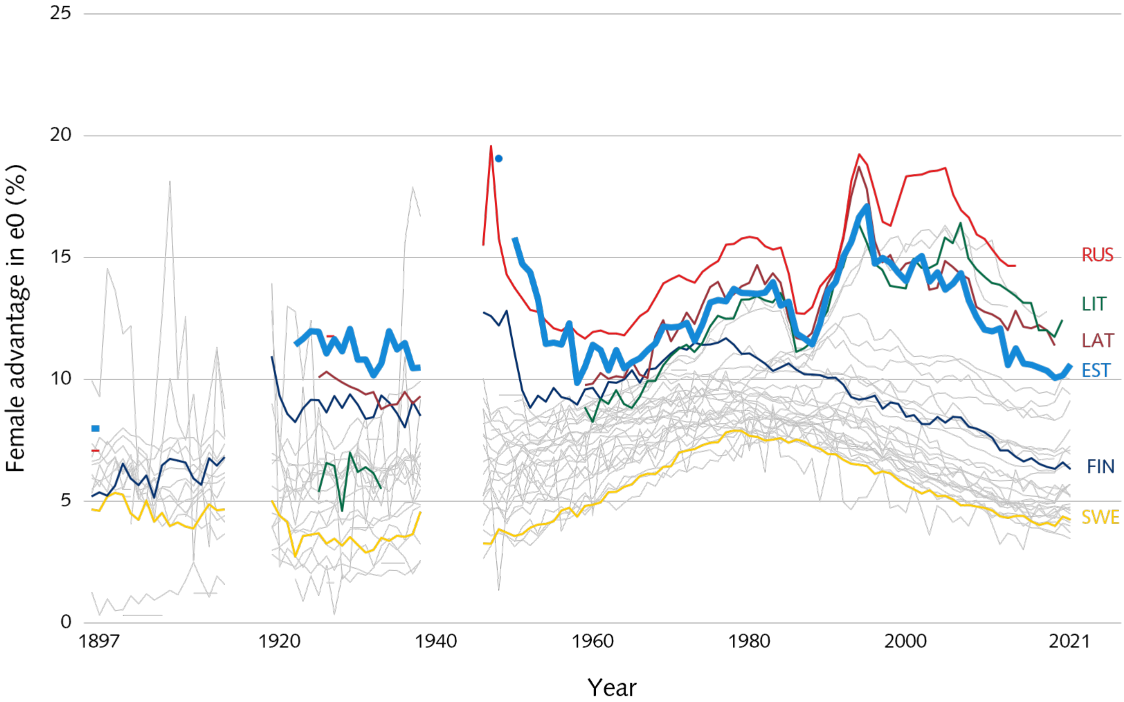
However, for some European countries, especially in southern and eastern parts of the continent, it has been claimed that female births and subsequent infant deaths were to some extent under-registered or missing during the late 19th and early 20th centuries (Beltrán Tapia & Szołtysek, 2022). This would also influence the sex gap in life expectancy to appear more favourable to men and could explain the almost non-existent sex differences in longevity observed for some countries in Figure 1, which might make the Estonian sex gap appear comparatively larger.[5] Additionally, this could clarify why the sex difference in Russia is smaller at this time (Malein & Beltrán Tapia, 2022).

3 Jaadla et al. (2017) also computed life tables for Tartu in 1896–1897. During this time, life expectancy at birth was 41.9 for men and 45.5 for women, meaning that relative difference was 8%.

4 During the war years, the largest sex disparity was recorded in France in 1915, when the life expectancy at birth of men was only 52% of that of women.

5 For Estonia, such abnormal sex ratios at birth are not identified.

Figure 1 *Life expectancy at birth (e0) sex gap in Estonia and other countries, 1897–2021*



Data: Katus and Puur (1991, 2004), Statistics Estonia (2024), Norkus et al. (2022), Human Mortality Database (2024), Human Life-Table Database (2024), own calculation. Apart from Estonia, Sweden, Finland, Latvia, Lithuania and Russia which are given in colour, the included countries are Norway, Denmark, Iceland, Belgium, the Netherlands, Luxembourg, France, England & Wales, Scotland, Northern Ireland, Ireland, Switzerland, Austria, Italy, Spain, Portugal, Hungary, Poland, Czechia, Slovakia, Slovenia, Russia, Ukraine, Belarus, Bulgaria, USA, Canada, Australia, New Zealand.

During the interwar independence period, male life expectancy in Estonia was consistently 10–13% lower than that of women. The disparity was clearly larger than in the other countries included in the analysis. A similarly pronounced gap was also observed in all neighbouring countries highlighted in Figure 1, with the exception of Russia, which experienced exceptionally high mortality due to economic experimentation and political violence (Andreev et al., 1993). We may assume that these events contributed to a sizable sex difference in life expectancy. Iceland exhibited a larger life expectancy gap than Estonia in some years, and, unsurprisingly, Spain also experienced a larger disparity between male and female life expectancy during the Civil War of the late 1930s.

The largest sex gap in life expectancy at birth in Estonia was recorded in 1948, when male life expectancy was 19% lower than female life expectancy. Under peacetime conditions, such a disparity is exceptionally large. Three years after the end of the war, male and female life expectancy in most other war-affected European countries had become much more similar. Only Estonia, Russia, and Finland exhibited a male–female longevity difference exceeding 10%. However, given the existence of millions of people in various concentration and labour camps, the Russian life table estimates — and the corresponding sex gap — should be interpreted with caution (Andreev et al., 1993).

As noted, the data on population composition for 1948 in Estonia do not derive from a standard statistical source. During the postwar years, many people — predominantly men — hid from, and at times fought against, the Soviet authorities, making it difficult to determine whether the sex gap in longevity would have been even larger had data on the undocumented population been available. Given the harsh living conditions and political violence of the period, our estimates likely underestimate the sex gap in life expectancy at birth. Furthermore, it should be noted that 1948 was a comparatively peaceful year in terms of deaths among people living in hiding, relative to 1946–1947 and 1949, when Soviet security forces were responsible for higher levels of mortality (Tannberg, 1999). Consequently, the actual sex disparity in longevity may have been even greater in those years.

In the 1950s, the sex gap in life expectancy in Estonia narrowed, reaching approximately 10% around 1960. Similar differences were observed in Finland, Latvia, Lithuania, Belarus, and Ukraine, although the gap remained smaller than in Russia. During the 1960s, the sex gap widened once again in the Soviet republics, while a more moderate widening also occurred elsewhere in Europe. From the 1980s onward, when Western countries were again reducing the gap, the post-Soviet states experienced sex differences in life expectancy exceeding 15%, particularly during the turbulent 1990s. In Estonia, the peak was reached in 1995, when the life expectancy gap widened to 17%. In the 21st century, this disparity gradually narrowed to around 10% by 2021. However, the difference between male and female life expectancy remains considerably smaller in neighbouring Sweden and Finland.

3.2 DECOMPOSITION BY AGE

Figure 2 presents the results of the decomposition analysis of age-specific contributions to the sex gap in life expectancy, distinguishing six age groups for Estonia and several other countries. The selection of comparison countries is based on both geographical proximity and divergence in sociopolitical developments, particularly in the context of the Cold War. The aim of the decomposition is to identify which age groups contributed most to the sex gap in longevity and to compare these patterns across countries. The analysis is conducted for Estonian census years, which provide the most reliable estimates of population structure, with the sole exception of 1948. The most basic conclusion is that the age-specific contributions changed substantially over time.

In 1897, almost two years — or, in relative terms, roughly half — of the sex gap in life expectancy at birth in Estonia was due to higher male infant mortality. In 1934, the contribution in absolute terms was similar; in relative terms, however, it had declined to below 25%. In 1948, higher mortality among male infants still accounted for more than 1.5 years of the sex gap, although in relative terms the contribution had fallen to around 15%. This underlines that the harsh conditions of postwar Estonia affected not only adults but also newborns.[6] From 1959 onward, infant mortality had only a negligible effect on the sex gap in longevity. The contribution of the 1–14 age group was likewise minimal throughout the entire period under study.

Differential mortality in the 15–29 age group had a sizable impact on the sex disparity in 1948, when men lost three years of life expectancy relative to women. This age group also contributed to the sex gap in other years, with the exception of the most recent census year. Similarly, the 30–49 age group had its largest impact in 1948, when nearly four years of the sex gap were attributable to differential mortality within this age range. The contribution of this age group was also considerable between 1979 and 2000.

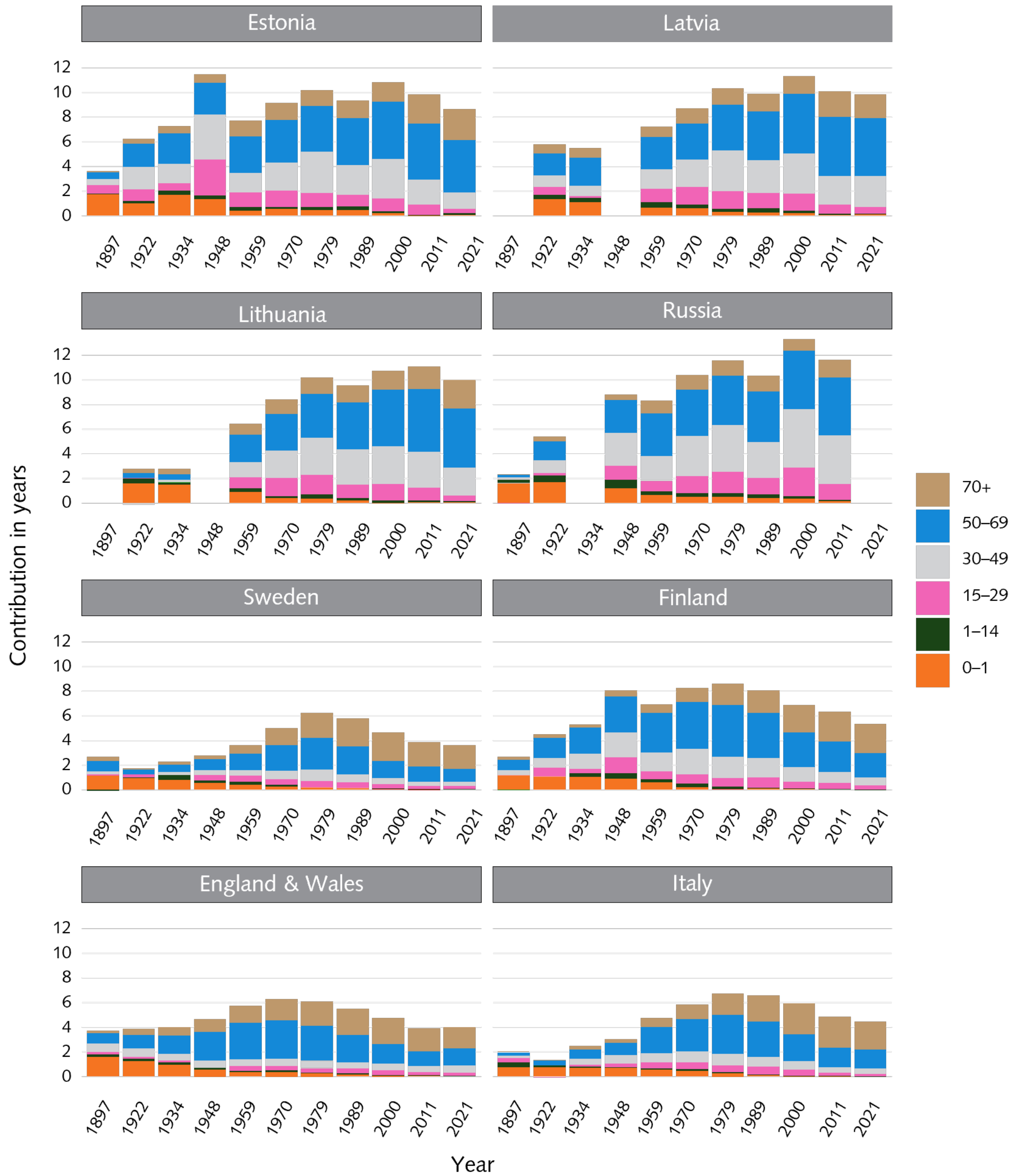
Individuals aged 50–69 contributed almost nothing to the sex gap in longevity at the end of the 19th century. By the interwar period, however, this age group accounted for around two years, or roughly one quarter, of the sex gap. In the postwar period, its contribution increased to approximately four years, representing nearly half of the gap in relative terms. Mortality in the oldest age group (70+) had only a modest effect on male–female differences in life expectancy before 1959, but its contribution subsequently increased. In the most recent census year, it accounted for 2.5 years, or 29%, of the total sex gap.

Comparing these age patterns to results of other countries depicted on Figure 2, as well as previous similar analyses (Deboosere, 2016; Kohli, 2016; Maiolo & Reid, 2020; Maiolo et al., 2023; van Poppel & Janssen, 2016), reveals broadly similar distributions before the Second World War. In Sweden, Norway, and Finland, the contribution of the first year of life was already substantially smaller around the turn of the century due to earlier declines in infant mortality. The same appears to have been true for Italy; however, this pattern specifically, and the comparatively smaller sex gap in life expectancy at birth more generally, may indicate sex-based discrimination against females at various ages (Beltrán Tapia & Cappelli, 2024). The contribution of differential infant mortality to the sex gap in Estonia also remained relatively large during the interwar period compared to Western Europe. Nevertheless, the largest contribution to the sex gap in both 1922 and 1934 still derived from differential male and female survival among individuals aged 30–69. Patterns observed in Finland during the interwar years were similar to those in Estonia.

In 1948, the 15–49 age group made a particularly large contribution to the female advantage in life expectancy. This contribution was even greater than in Russia. Unfortunately, no life tables exist for Latvia and Lithuania for this period, although these countries also suffered under Soviet occupation. Finland likewise exhibited a rather large sex gap in longevity in 1948; however, the mortality differential among individuals aged 15–49, and more generally the elevated mortality of military-aged men, was less pronounced, even though Finland had been heavily affected by the war and reparations payments to the Soviet Union placed a substantial burden on living standards.

6 Infant mortality rate in 1948 was at 84, in 1947 it was even 121.

Figure 2 *Age contributions to the sex gap in life expectancy at birth in Estonia and seven other countries, decomposition analysis*



Data: Katus and Puur (1991, 2004), Statistics Estonia (2024), Norkus et al. (2022), Human Mortality Database (2024). Human Life-Table Database (2024), own calculation based on Arriaga (1984). For Russia, 1922 actually refers to 1926–27; for Latvia and Lithuania 1922 refers to 1925.

Additionally, from 1959 onward, the contribution of working-age mortality to the male longevity disadvantage was much greater in Estonia and the other Soviet states than in Western Europe, where a larger share of the sex gap had already shifted earlier toward mortality differences at older ages. Finland occupied an intermediate position between the Western and Eastern European patterns.

3.3 DECOMPOSITION BY CAUSE OF DEATH

Figure 3 gives contributions to the sex gap in Estonia based on the cause of death, in which the ability to provide a comparative view is constrained, since harmonised open access databases only start from the post-WWII years, or even from the end of the 20th century (Human Cause-of-Death Database, 2024). Hence, Figure 3 only includes data for Estonia. Comparisons to other countries are given in the text based on previous studies with a similar focus.

Seven disease categories are distinguished, in addition to the categories "other" and "unknown." No cause of death data is available for 1897 and 1922. Notably, the share of the sex gap attributable to unknown causes is sizable in 1934 and especially in 1948, reflecting the lower quality of cause of death registration during these years. The observed patterns suggest that some of these unknown causes would most likely be reallocated to circulatory diseases (whose share is lower in 1934 and 1948 than in later years) and neoplasms (the only category exhibiting a slight female disadvantage in 1934 and 1948).

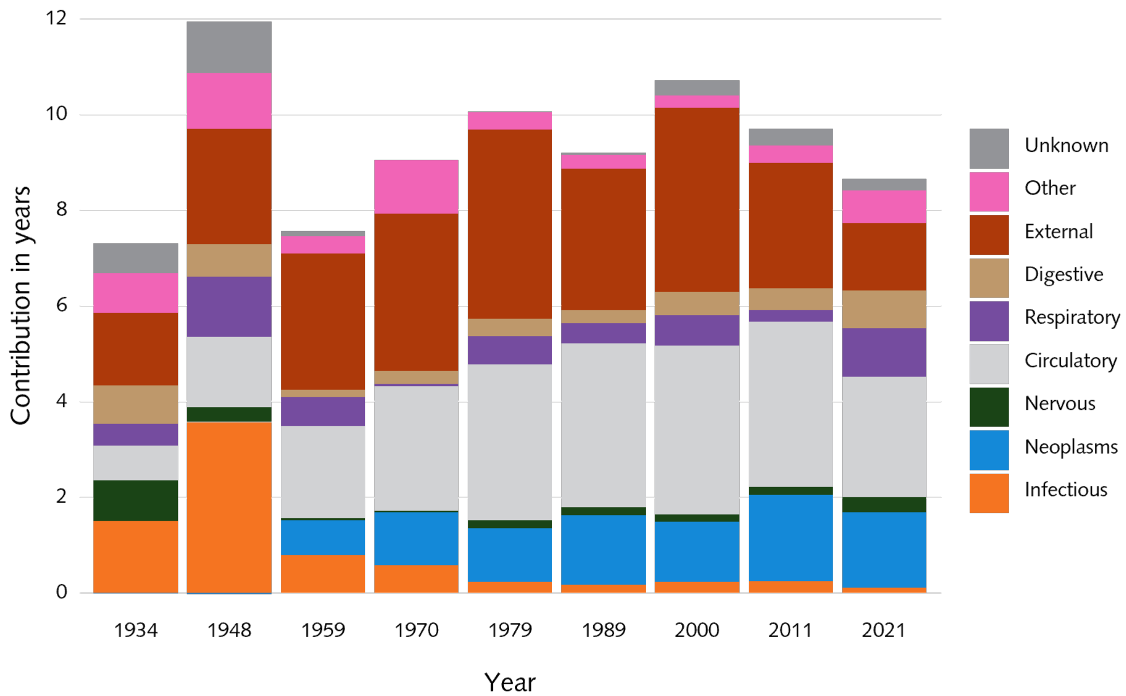
Figure 3 indicates that all disease groups distinguished for all years contributed to the male disadvantage, except for neoplasms in 1934 and 1948, which exhibited a very small male advantage. The earlier years display a more diverse pattern, whereas from 1959 onward the dominance of three main groups — neoplasms, cardiovascular diseases, and external causes — became pronounced.

The share of the sex gap attributable to infectious diseases is surprisingly small in 1934, which may partly reflect misclassification of causes of death. On the other hand, it is striking that infectious diseases accounted for the largest share — nearly one third — of the life expectancy difference in 1948. Looking at the death counts in greater detail, tuberculosis was the primary cause (Kalling et al., 2018, p. 40).

The same applies to respiratory diseases, which contribute the most to the male survival disadvantage in 1948. The socialist states were successful in fighting infection diseases after the death of Stalin, when people's livelihoods and wellbeing became a bigger political priority. Infectious diseases lost its importance in male-female difference in life from 1959 onwards (Kalling et al., 2018, pp. 100–111).

The contribution of neoplasms, on the other hand, was virtually non-existent in 1934 and 1948 but became increasingly important in later years. As has been noted elsewhere (Reid et al., 2015, p. 330), many deaths recorded as due to "old age" or "senility" during the 19th and early 20th centuries were in practice likely deaths caused by neoplasms, as these disproportionately affect older individuals. Given that breast cancer was easier to diagnose than many of the cancers more commonly affecting men, it is probable that the available data underestimate the contribution of neoplasms to male–female differences in longevity (Maiolo & Reid, 2020). On Figure 3, ill-defined causes are allocated under "other." Some of the undiagnosed cancers may also appear under the diseases related to specific organs.

Figure 3 *Cause of death contributions to the sex gap in life expectancy at birth in Estonia, decomposition analysis*



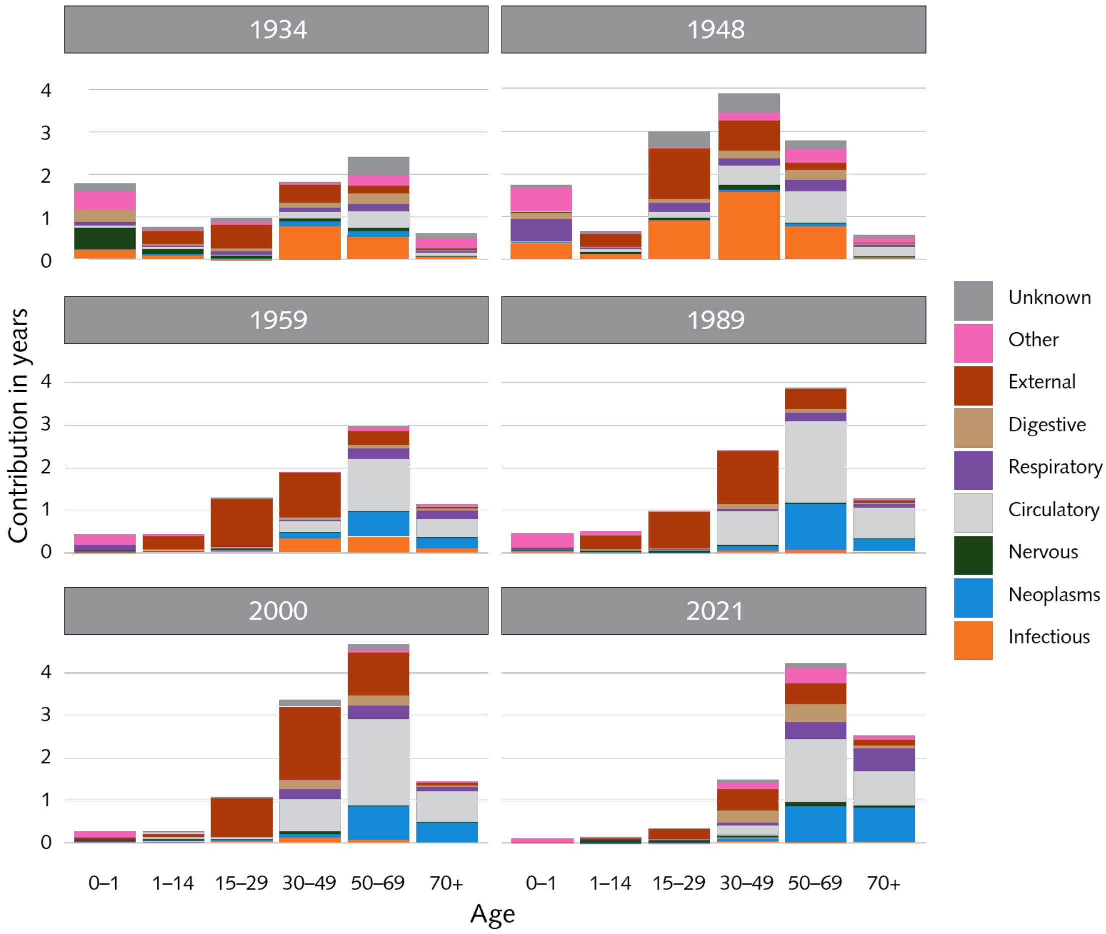
Data: Katus and Puur (1991, 2004), Statistics Estonia (2024), Human Mortality Database (2024), own calculation based on Arriaga (1984).

In addition, some cardiovascular deaths may have been misclassified as "old age" or "senility" in 1934 and 1948. This makes the subsequent increase in the contribution of cardiovascular diseases to the sex gap in life expectancy appear more pronounced. The absence of the "cardiovascular revolution" in Soviet Estonia is also evident from Figure 3, given the major contribution of cardiovascular diseases to the male mortality disadvantage. Although substantial progress has been made in recent decades in Estonia through the adoption of new medical methods and the promotion of healthier lifestyles (Shkolnikov et al., 2018), cardiovascular deaths have a considerable effect on male mortality in Estonia to this day.

The contribution of external causes was not at its highest in 1948 but became particularly pronounced between 1959 and 1979, when it accounted for almost 40% of the mortality difference. This is somewhat surprising, as it suggests that the large sex gap in longevity in 1948 was driven more by the general social environment than directly by violence, political developments, or warfare-related factors. This interpretation is further supported by more detailed death counts, which show that in 1948 substantially more men died from suicide, work-related injuries, and unspecified traumas. In contrast, with respect to interpersonal violence, the male–female difference was smaller and comparable to that observed in other census years. In later years, various types of accidents contributed substantially to the sex gap, many of them likely involving alcohol consumption (Leinsalu, 1995). It is, however, difficult to exactly measure alcohol-related mortality with accidents. On the whole mortality caused primarily or partly by alcohol (as well as it can be measured) has a rather limited contribution to the sex gap (Trias-Llimós & Janssen, 2018).

A similar pattern of rather equal distributions of the different causes on male mortality disadvantage is also evident for the interwar period in other countries, such as England and Wales, Norway, the Netherlands, and Belgium (Deboosere, 2016; Maiolo & Reid, 2020; Maiolo et al., 2023; van Poppel & Janssen, 2016). For the post-WWII period, patterns in Western Europe and the Nordic countries differed markedly, as infectious diseases and external causes contributed far less to the male–female disparity in life expectancy than in Estonia.

Figure 4 *Age and cause of death contributions to the sex gap in life expectancy at birth in Estonia, decomposition analysis*



Data: Katus and Puur (1991, 2004), Statistics Estonia (2024), Human Mortality Database (2024), own calculation based on Arriaga (1984).

Figure 4 gives the results of the decomposition by age and cause of death, but only for the years 1934, 1948, 1959, 1989, 2000 and 2021, due to space constraints, but which are enough to show the changes during this period.

In 1934 and 1948, the contribution of infectious diseases during infancy is surprisingly small. In the 1930s and 1940s, infectious diseases appear to have had a stronger impact on adult male mortality, particularly among those aged 30–69, whereas no single cause of death category dominated among infants. The relatively even distribution of causes contributing to male–female differences in life expectancy is also evident across other age groups. In 1948, deaths due to infectious diseases and external causes dominated, at least among individuals aged 15–49. In the later years, external causes are particularly notable for contributing most to the sex gap among those aged 15–49, while circulatory diseases and neoplasms became the dominant contributors among individuals aged 50 and above.

4 CONCLUSION AND DISCUSSION

This paper set out to examine the long-term development of the sex gap in life expectancy in Estonia, a country that has experienced a comparatively large disparity in male and female survival over the past half-century. Here, we summarise the main findings and offer possible explanations rooted in broader societal developments.

The analysis confirms that Estonia has exhibited a large sex gap in longevity compared to other countries since the 19th century, with male life expectancy remaining almost consistently more than ten percent lower than that of women. In terms of age- and cause-specific contributions to the sex gap, the observed patterns largely follow the trends associated with the different stages of the health transition (Vallin & Meslé, 2004). With respect to age, the main contribution shifted progressively from younger to older age groups. In terms of causes of death, a combination of many different disease categories contributed to the sex gap in longevity before the Second World War, whereas from the 1950s onward cardiovascular diseases, neoplasms, and external causes became dominant in explaining mortality differentials. The situation in the immediate postwar years, and to a lesser extent during the final decades of the 20th century, diverged greatly from the patterns observed in Western Europe (Deboosere, 2016; Maiolo & Reid, 2020; Maiolo et al., 2023; van Poppel & Janssen, 2016).

What broader societal factors underlay the development of the large sex gap in life expectancy in Estonia? Our analysis does not establish causal relationships; however, in the following sections we discuss several hypotheses based on previous literature on mortality developments in Estonia.

Estonia exhibited a comparatively large sex gap in survival already in the 19th and early 20th centuries, with only Iceland and, before the end of the 19th century, Sweden displaying greater disparities. In the Swedish case, the large sex gap in the late 19th century has been explained by the early demographic transition and the resulting population pressure, which contributed to un- and underemployment and problems related to alcoholism that affected men disproportionately because of their socially expected roles as primary breadwinners (Willner, 2016). In more developed economies, industrialisation and poor working conditions also resulted in an increased sex gap in life expectancy. This was especially the case during the late 19th century, given that men were more likely to be employed in industry in greater shares (Maiolo & Reid, 2020).

Neither explanation applies in the Estonian case, since the population growth was very small during demographic transition (Gortfelder, 2020, pp. 27–28), and industrialisation only took off around the turn of the century, and at a lower scale (Pihlamägi, 1999). In Estonia, alcoholism was identified as a social problem as early as the 18th century and given the likely higher prevalence of alcohol consumption among men, it may have contributed to elevated male mortality. Unfortunately, quantitative data on alcohol consumption in Estonia for this period are non-existent (Kalling & Tammiksaar, 2020).

However, Estonia was characterised by an acute land shortage until the radical land reform in 1919 due to the outsized power of large landowners and manorial economy compared to Western Europe (Rosenberg, 2013; Roszkowski, 1995). In 1897, over half of the peasantry was still landless or semi landless (Siilivask, 1990, pp. 229–235). Using the same logic as applied to men in Sweden, then the inability to provide for their families may have impacted landless peasants and their health and survival in Estonia (Klesment & Lust, 2021b). Additionally, it is probable that like in rural Scotland, (Reid & Garrett, 2018) tuberculosis hit men harder than women in the Estonian countryside, which would influence the sex gap at the national level due to a much lower urbanisation rate compared to Western Europe.

The large gap in male and female life expectancy during the interwar years can no longer be explained by the unequal concentration of land ownership in the countryside. We also observe little correlation with the business cycle, nor is there evidence that working conditions in industry deteriorated during this period (Klesment, 2008). Estonian men fought in the First World War and subsequently in the War of Independence, but it seems unlikely that these conflicts affected Estonian men more severely than men in other countries involved in the same wars. Moreover, previous research has shown that sex differentials in mortality were not substantially different in neutral countries, which downplays the role of war in widening sex differences in life expectancy during the interwar years (Dinges & Weigl, 2016a, p. 194).

It has also been argued that declining tuberculosis mortality contributed to increasing sex differences in life expectancy because the disease affected women disproportionately (Dinges & Weigl, 2016a, p. 199). However, in interwar Estonia, tuberculosis mortality was consistently around twice as high among men (Lasberg, 1929; Rumma, 1939), possibly because less than one third of the population resided in urban municipalities. Indeed, our decomposition analysis also shows that infectious diseases made the greatest contribution to the sex gap among the 30–49 and 50–69 age groups. It is difficult to determine to what extent working conditions were responsible for this pattern.

The large sex gap in life expectancy immediately after the Second World War can largely be explained by the Soviet occupation and Stalinism. Politically, the new regime was still engaged in suppressing opposition, with military-aged men bearing most of the burden. Economically, conditions were extremely poor, and improving living standards was not a priority for the political leadership (Mertelsmann, 2024). Furthermore, under Soviet rule, a rapid industrialisation drive commenced, disproportionately affecting male workers, who were exposed to poor working and housing conditions. In addition, during the war a large share of medical personnel either lost their lives, were deported or emigrated, which may have been particularly detrimental for seriously wounded former soldiers (Kalling et al., 2018, p. 104).

The difficulties experienced by socialist societies in adopting the methods and practices associated with the cardiovascular revolution are well known and also apply to Soviet Estonia (Aburto & van Raalte, 2018; Meslé, 2004; Vallin & Meslé, 2004). We note here that the greater prevalence of cardiovascular mortality among men may partly reflect biological factors (Maas & Appelman, 2010), although greater risk-taking behaviour among men was also an important factor, particularly with respect to deaths from external causes (Baburin et al., 2011; Leinsalu, 1995). This is highlighted in our results by the substantial contribution of the 30–49 age group to the sex gap, which stands in stark contrast to patterns observed in Western Europe. At the same time, the Soviet Union lagged behind the West in terms of occupational safety standards, which disproportionately affected working-age men. In addition to these social factors, mass immigration from Russia may also have contributed to mortality patterns in Estonia appearing more similar to those observed in Russia itself.

Studies analysing the development of the sex gap in life expectancy in Western Europe have underlined the importance of smoking as a major risk behaviour with much higher prevalence among men (Deboosere, 2016; Maiolo & Reid, 2020; van Poppel & Janssen, 2016). The higher prevalence of smoking among men is thought in part to have been a consequence of war, as men in military service used smoking as a means of relaxation (Dinges & Weigl, 2016a, pp. 201–202). Similarly, in Soviet Estonia, smoking was regarded as one of the few simple pleasures in life (Pärna et al., 2002). We lack good data on the historical development of smoking behaviour. However, already in the 1960s, mortality from lung cancer was 10 times higher among men, indicating that smoking must also have been an important factor during the interwar period (Aareleid et al., 1994; Leinsalu & Rahu, 1993). In Estonia, and more broadly across the region, the higher prevalence of alcohol consumption is also noteworthy, even though it remains difficult to assess the role of alcohol in all accidental deaths (Stickley et al., 2007; Trias-Llimós & Janssen, 2018).

Estonia has been successful in increasing life expectancy since the 1990s, and the sex gap has diminished accordingly (Jasilionis et al., 2011; Meslé & Vallin, 2017; Shkolnikov et al., 2018). Nevertheless, the gap remains roughly twice as large as in neighbouring Finland and Sweden. The results show that, in terms of age, the current disparity is primarily driven by elevated male mortality above age 50. In terms of causes of death, cardiovascular diseases and neoplasms dominate, while the contribution of external causes has diminished considerably.

ACKNOWLEDGMENTS

This work was supported by the Estonian Research Council grant (PSG669). The author wishes to thank Hannaliis Jaadla for help.

REFERENCES

Aareleid, T., Leinsalu, M., Rahu, M., & Baburin, A. (1994). Lung cancer in Estonia in 1968–87: Time trends and public health implications. *European Journal of Cancer Prevention*, *3*(5), 419–425.

Aburto, J. M., & van Raalte, A. (2018). Lifespan dispersion in times of life expectancy fluctuation: The case of Central and Eastern Europe. *Demography*, *55*(6), 2071–2096. https://doi.org/10.1007/s13524-018-0729-9

Andreev, E. M., Darsky, L. E., & Kharkova, T. L. (1993). *Naselenie Sovetskogo Soyuza 1922–1991*. [Population of the Soviet Union 1922–1991]. Nauka.

Arriaga, E. E. (1984). Measuring and explaining the change in life expectancies. *Demography*, *21*(1), 83–96. https://doi.org/10.2307/2061029

Baburin, A., Lai, T., & Leinsalu, M. (2011). Avoidable mortality in Estonia: Exploring the differences in life expectancy between Estonians and non-Estonians in 2005–2007. *Public Health*, *125*(11), 754–762. https://doi.org/10.1016/j.puhe.2011.09.005

Beltrán Tapia, F. J., & Cappelli, G. (2024). Missing girls in Liberal Italy, 1861–1921. *The Economic History Review*, *77*(1), 185–211. https://doi.org/10.1111/ehr.13257

Beltrán Tapia, F. J., & Szołtysek, M. (2022). 'Missing girls' in historical Europe: Reopening the debate. *The History of the Family*, *27*(4), 619–657. https://doi.org/10.1080/1081602X.2022.2132979

Deboosere, P. (2016). The evolution of the gender gap in life expectancy in Belgium and the smoking epidemic (1841 to 2013). In M. Dinges & A. Weigl (Eds.), *Gender-specific life expectancy in Europe 1850–2010* (pp. 89–110). Franz Steiner Verlag.

Dinges, M., & Weigl, A. (2016a). Gender gap similarities and differences in Europe. In M. Dinges & A. Weigl (Eds.), *Gender-specific life expectancy in Europe 1850–2010* (pp. 187–216). Franz Steiner Verlag.

Dinges, M., & Weigl, A. (Eds.). (2016b). *Gender-specific life expectancy in Europe 1850–2010*. Franz Steiner Verlag.

Gortfelder, M. (2020). *Fertility modernisation in Estonia: An analysis of individual-level data for women born 1850–1899* [Unpublished doctoral dissertation]. Tallinn University, Estonia. https://www.etera.ee/zoom/84891/view?page=1&p=separate&tool=info

Jaadla, H., Puur, A., & Rahu, K. (2017). Socioeconomic and cultural differentials in mortality in a late 19th century urban setting: A linked records study from Tartu, Estonia, 1897–1900. *Demographic Research*, *36*(1), 1–40. https://doi.org/10.4054/DemRes.2017.36.1

Janssen, F., & Kunst, A. E. (2004). ICD coding changes and discontinuities in trends in cause-specific mortality in six European countries, 1950–99. *Bulletin of the World Health Organization*, *82*(12), 904–913.

Jasilionis, D., Meslé, F., Shkolnikov, V. M., & Vallin, J. (2011). Recent life expectancy divergence in Baltic countries. *European Journal of Population*, *27*(4), 403–431. https://doi.org/10.1007/s10680-011-9243-0

Kaasik, P., Varik, A., Tomingas, M., Raudma, T., Haagensen, U., Haagensen, M., Tammisto, P., Harding, A., Tarand, K., Hiio, T., Maripuu, M., Paavle, I., Meri, L., Tammiksaar, A., & Timmerman, S. (Eds). (2009). *Estonia since 1944: Reports of the Estonian International Commission for the Investigation of Crimes Against Humanity*. Inimsusevastaste Kuritegude Uurimise Eesti Sihtasutus.

Kalling, K., Ots, T.-M., Moorlat, M., & Toots, E. (2018). *Eesti meditsiini 100 aastat* [100 Years of Estonian medicine]. Post Factum.

Kalling, K., & Tammiksaar, E. (2020). "See on tõepoolest häbiväärne, et meie eestlastel on rohkem mõistust kui meie sakslastel" ["It is truly disgraceful that Estonians have more sense than our Germans"]. *Tartu Ülikooli Ajaloo Küsimusi*, *48*, 63–79. https://doi.org/10.15157/tyak.v48i48.16887

Katus, K. (2000). *Long-term mortality trend in the Baltic countries*. Eesti Kõrgkoolidevaheline Demouuringute Keskus.

Katus, K., & Puur, A. (1991). Eesti rahva suremusest [On the mortality of the Estonian population]. *Akadeemia*, *3*(12), 2516–2549.

Katus, K., & Puur, A. (2004). *Life tables. Estonia 1923–1938 and 1950–2000*. Eesti Kõrgkoolidevaheline Demouuringute Keskus.

Klesment, M. (2008). Eesti majandusarengu dünaamika [Dynamics of Estonia's economic development]. *Tuna.Ajalookultuuri Ajakiri*, 1, 25–37.

Klesment, M., & Lust, K. (2021a). Kui vanaks elasid maainimesed Eestis 19. Sajandil?: Ajaloodemograafia projekti valitud tulemusi [Life expectancy of rural inhabitants in 19th-century Estonia: Selected findings from the historical demography project]. *Demograafia blogi*. https://demograafia30.weebly.com/blog_30.html

Klesment, M., & Lust, K. (2021b). Short-term economic stress and mortality differentials in rural Estonia, 1834–1884. *Scandinavian Economic History Review*, *69*(1), 22–40. https://doi.org/10.1080/03585522.2020.1739121

Kohli, R. (2016). The evolution of the gender gap in Sweitzerland since 1876. In M. Dinges & A. Weigl (Eds.), *Gender-specific life expectancy in Europe 1850–2010* (pp. 167–176). Franz Steiner Verlag.

Laar, M. (2013). *Metsavennad: Relvastatud vastupanu Eestis Teise maailmasõja järel* [Forest brothers: Armed resistance in Estonia following the Second World War]. Read.

Laarmaa, A. (2009). *Rahvastiku loomulik liikumine Tartumaal 1800–1899 (luteri ja õigeusu kirikumeetrikate andmetel)* [The natural movement of population in Tarty County 1800–1899 (based on Lutheran and Orthodox church books)] [Unpublished master's thesis]. University of Tartu, Estonia.

Lasberg, E. (1929). Surmapõhjused 1927 [Causes of death in 1927]. *Eesti Statistika*, *87*(2), 101–112.

Leinsalu, M. (1995). Time trends in cause-specific mortality in Estonia from 1965 to 1989. *International Journal of Epidemiology*, *24*(1), 106–113. https://doi.org/10.1093/ije/24.1.106

Leinsalu, M., & Rahu, M. (1993). Time trends in cancer mortality in Estonia 1965–1989. *International Journal of Cancer*, *53*(6), 914–918. https://doi.org/10.1002/ijc.2910530608

Leinsalu, M., Vågerö, D., & Kunst, A. E. (2003). Estonia 1989–2000: Enormous increase in mortality differences by education. *International Journal of Epidemiology*, *32*(6), 1081–1087. https://doi.org/10.1093/ije/dyg192

Leinsalu, M., Vågerö, D., Kunst A. E. (2004). Increasing ethnic differences in mortality in Estonia after the collapse of the Soviet Union. *Journal of Epidemiology & Community Health*, *58*(7), 583–589. https://doi.org/10.1136/jech.2003.013755

Leon, D. A. (2011). Trends in European life expectancy: A salutary view. *International Journal of Epidemiology*, *40*(2), 271–277. https://doi.org/10.1093/ije/dyr061

Luy, M. (2016). The impact of biological factors on sex differences in life expectancy: Insights gained from a natural experiment. In M. Dinges & A. Weigl (Eds.), *Gender-specific life expectancy in Europe 1850–2010* (pp. 17–46). Franz Steiner Verlag.

Maas, A. H. E. M., & Appelman, Y. E. A. (2010). Gender differences in coronary heart disease. *Netherlands Heart Journal*, *18*, 598–603. https://doi.org/10.1007/s12471-010-0841-y

Maiolo, V., Keilman, N., & Gjertsen, F. (2023). Sex-differences in life expectancy at birth: A descriptive analysis of the contributions of age and causes of death to the gap in Norway, 1881–2011. *Social Sciences & Humanities Open*, *8*(1), Article 100450. https://doi.org/10.1016/j.ssaho.2023.100450

Maiolo, V., & Reid, A. M. (2020). Looking for an explanation for the excessive male mortality in England and Wales since the end of the 19th century. *SSM - Population Health*, *11*, Article 100584. https://doi.org/10.1016/j.ssmph.2020.100584

Malein, V., & Beltrán Tapia, F. J. (2022). Infant and child sex ratios in late Imperial Russia. *The History of the Family*, *27*(4), 736–763. https://doi.org/10.1080/1081602X.2022.2098509

Max Planck Institute for Demographic Research (Germany), University of California, Berkeley (USA), & French Institute for Demographic Studies (France). (2024). *HCD (The Human Cause-of-Death Data series)* [Data set]. MPIDR. https://www.mortality.org/Data/HCD

Max Planck Institute for Demographic Research (Germany), University of California, Berkeley (USA), & French Institute for Demographic Studies (France). (2024). *HLD (Human Life-Table Database* [Data set]. MPIDR. http://www.lifetable.de

Max Planck Institute for Demographic Research (Germany), University of California, Berkeley (USA), & French Institute for Demographic Studies (France). (2024). *HMD (Human Mortality Database)* [Data set]. MPIDR. https://www.mortality.org/Country/Country?cntr=EST

McCann, J. C. (1976). A technique for estimating life expectancy with crude vital rates. *Demography*, *13*(2), 259–272. https://doi.org/10.2307/2060805

Mertelsmann, O. (2024). *Stalinist restructuring in Estonia. From market to command economy*. Peter Lang.

Meslé, F. (2004). Mortality in Central and Eastern Europe: Long-term trends and recent upturns. *Demographic Research*, *S2*, 45–70. https://doi.org/10.4054/DemRes.2004.S2.3

Meslé, F., & Vallin, J. (2017). The end of East-West divergence in European life expectancies? An introduction to the special issue. *European Journal of Population*, *33*, 615–627. https://doi.org/10.1007/s10680-017-9452-2

Norkus, Z., Jasilionis, D., Grytten, O. H., Mežs, I., & Klesment, M. (2022). Mortality transition in the interwar Baltic states: Findings from cross-country comparison of new life tables. *Scandinavian Economic History Review*, *72*(1), 1–24. https://doi.org/10.1080/03585522.2022.2106301

Oksuzyan, A., Dańko, M. J., Caputo, J., Jasilionis, D., & Shkolnikov, V. M. (2019). Is the story about sensitive women and stoical men true? Gender differences in health after adjustment for reporting behavior. *Social Science & Medicine*, *228*, 41–50. https://doi.org/10.1016/j.socscimed.2019.03.002

Pärna, K., Rahu, K., & Rahu, M. (2002). Patterns of smoking in Estonia. *Addiction*, *97*(7), 871–876. https://doi.org/10.1046/j.1360-0443.2002.00192.x

Pihlamägi, M. (1999). *Eesti industrialiseerimine, 1870–1940* [Industrialisation of Estonia 1870–1940]. Teaduste Akadeemia Kirjastus.

Pullerits, A., & Rammul, A. (1925). *Surmapõhjuste registreerimiskord ühes surmapõhjuste nimestikuga: Kasutamiseks praktiseerivatele arstidele* [Procedure for registering causes of death, accompanied by a list of causes of death: Intended for practising doctors]. Riigi Statistika Keskbüroo.

Pullerits, A., & Rammul, A. (Eds). (1931). *Surmapõhjuste registreerimiskord ja rahvusvaheline surmapõhjuste nomenklatuur* [Procedure for registering causes of death and the international nomenclature of causes of death]. Riigi Statistika Keskbüroo.

Pullerits, A., & Rammul, A. (1935). *Surmapõhjuste registreerimiskord ja rahvusvaheline surmapõhjuste nomenklatuur* [Procedure for registering causes of death and the international nomenclature of causes of death]. Riigi Statistika Keskbüroo.

Puur, A., Katus, K., & Põldma, A. (2005). *Development of population statistics: Baltic countries*. Eesti Kõrgkoolidevaheline Demouuringute Keskus.

Puur, A., & Uuet, L. (2010). Eesti NSV 1940.–1950. aastate valimiste materjalid rahvastikuloo allikana [Soviet elections in Estonia in the 1940s and 1950s as source material for Estonia's demographic history]. *Tuna. Ajalookultuuri ajakiri*, *2*, 61–82.

Rahu, K., Rahu, M., & Zeeb, H. (2019). Sex disparities in premature adult mortality in Estonia 1995–2016: A national register-based study. *BMJ Open*, *9*, Article e026210. https://doi.org/10.1136/bmjopen-2018-026210

Reid, A., & Garrett, E. (2018). Mortality, work and migration. A consideration of age-specific mortality from tuberculosis in Scotland, 1861–1901. *Historical Life Course Studies*, *6*, 111–132. https://doi.org/10.51964/hlcs9331

Reid, A., Garrett, E., Dibben, C., & Williamson, L. (2015). 'A confession of ignorance': Deaths from old age and deciphering cause-of-death statistics in Scotland, 1855–1949. *The History of the Family*, *20*(3), 320–344. https://doi.org/10.1080/1081602X.2014.1001768

Rootsmäe, L. (1987). *Nakkushaigused surma põhjustena Eestis 1711–1850* [Infectious diseases as causes of death in Estonia 1711–1850]. Valgus.

Rosenberg, T. (2013). Eesti 1919. aasta maareform: Võrdlusjooni Ida- ja Kesk-Euroopa maadega [The 1919 land reform in Estonia: Comparison with other Central and Eastern European countries]. In Rosenberg, T., *Künnivaod. Uurimusi Eesti 18.–20. sajandi agraarajaloost* (pp. 401–417). Tartu University Press.

Roszkowski, W. (1995). *Land reforms in East Central Europe after World War One*. Institute of Political Studies, Polish Acadmy of Sciences.

Rumma, K. (1935). Surmapõhjused 1933.a [Causes of death in 1933]. *Eesti Statistika*, *3*, 130–139.

Rumma, K. (1939). Surmapõhjused 1937.a [Causes of death in 1937]. *Eesti Statistika*, *2*, 65–74.

Sakkeus, L., & Karelson, K. (2008). Välispäritolu rahvastiku tervis [Health of the foreign-origin population]. *Eest Arst*, *88*, 24–36. https://doi.org/10.15157/ea.v0i0.10451

Saueauk, M. (2015). *Propaganda ja terror: Nõukogude julgeolekuorganid ja Eestimaa Kommunistlik Partei Eesti sovetiseerimisel 1944–1953* [Propaganda and terror: Soviet security agencies and the Estonian Communist Party during the Sovietisation of Estonia, 1944–1953]. SE&JS.

Saueauk, M., & Hiio, T. (Eds.). (2018). *Sovietisation and violence: The case of Estonia*. University of Tartu Press.

Shkolnikov, V. M., Andreev, E. M., Jasilionis, D., Leinsalu, M., Antonova, O. I., & McKee, M. (2006). The changing relation between education and life expectancy in Central and Eastern Europe in the 1990s. *Journal of Epidemiology & Community Health*, *60*(10), 875–881. https://doi.org/10.1136/jech.2005.044719

Shkolnikov, V. M., Danilova, I., Jdanov, D., Andreev, E., McKee, M., & Leon, D. (2018). Contrasting cardiovascular trajectories in Russia and Estonia: Are there lessons to be learnt as to how to increase life expectancy? *European Journal of Public Health*, *28*(suppl_4), Article cky213.873. https://doi.org/10.1093/eurpub/cky213.873

Siilivask, K. (1990). Socio-economic development of the Baltic countries at the beginning of the 20th century. In A. Loit (Ed.), *The Baltic countries 1900–1914* (pp. 229–244). Stockholm Universitet.

Statistics Estonia. (2024). *Statistics Estonia* [Data set]. https://stat.ee/en

Stickley, A., Leinsalu, M., Andreev, E., Razvodovsky, Y., Vågerö, D., & McKee, M. (2007). Alcohol poisoning in Russia and the countries in the European part of the former Soviet Union, 1970–2002. *European Journal of Public Health*, *17*(5), 444–449. https://doi.org/10.1093/eurpub/ckl275

Tannberg, T.-A. (1999). Relvastatud vastupanuliikumine Eestis aastatel 1944-1953 julgeolekuorganite statistikapeeglis [The armed resistance movement in Estonia 1944–1953 as reflected in security service statistics]. *Tuna. Ajalookultuuri ajakiri*, *1*, 24–30.

Torres, C. (2020). *Life expectancy in urbanizing contexts: Patterns and causes of changes in mortality in historical populations* [Ph.D. thesis, University of Southern Denmark]. Syddansk Universitet. Det Sundhedsvidenskabelige Fakultet. https://doi.org/10.21996/13hx-6h08

Trias-Llimós, S., & Janssen, F. (2018). Alcohol and gender gaps in life expectancy in eight Central and Eastern European countries. *European Journal of Public Health*, *28*(4), 687–692. https://doi.org/10.1093/eurpub/cky057

Trias-Llimós, S., Kunst, A. E., Jasilionis, D., & Janssen, F. (2018). The contribution of alcohol to the East-West life expectancy gap in Europe from 1990 onward. *International Journal of Epidemiology*, *47*(3), 731–739. https://doi.org/10.1093/ije/dyx244

Vahtre, S. (1973). *Eestimaa talurahvas hingeloenduste andmeil (1782–1858): Ajaloolis-demograafiline uurimus* [Estonian peasantry based on soul census records (1782–1858): A historical-demographic study]. Eesti Raamat.

Vallin, J., Jasilionis, D., & Meslé, F. (2017). Does a turbulent history lead to turbulent life expectancy trends? Evidence from the Baltic States. *Historical Methods: A Journal of Quantitative and Interdisciplinary History*, *50*(4), 191–209. https://doi.org/10.1080/01615440.2017.1338977

Vallin, J., & Meslé, F. (2004). Convergences and divergences in mortality: A new approach of health transition. *Demographic Research*, *S2*, 11–44. https://doi.org/10.4054/DemRes.2004.S2.2

van Poppel, F., & Janssen, F. (2016). The mortality gender gap in the Netherlands 1850–2000. In M. Dinges & A. Weigl (Eds.), *Gender-specific life expectancy in Europe 1850–2010* (pp. 111–130). Franz Steiner Verlag.

Willner, S. (2016). Gender-specific life expectancies in Sweden 1810–1980. In In M. Dinges & A. Weigl (Eds.), *Gender-specific life expectancy in Europe 1850–2010* (pp. 131–148). Franz Steiner Verlag.