

About Estonia Data on Causes of Death

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General

The Estonian statistical office was established in 1921 under the name State Statistical Central Bureau. Estonia was incorporated into the Soviet Union in 1940, and until 1989 the state statistical service was subordinate to the *Central Statistical Office* of the Union of Soviet Socialist Republics (USSR). In 1977, important restrictions were imposed by the *Central Statistical Office* regarding the amount of the published data. In 1989, the Statistical Office of the Republic of Estonia was re-established and renamed "Statistics Estonia" in 1992. The data on vital events of Estonia have been published and publicly available only since 1991. In 1993, an extensive re-organization took place in Statistics Estonia, in the course of which a new structure was established and the main functions of the agency were brought into accordance with the needs of the independent state and international requirements. The structure of Statistics Estonia was again reorganized in 1994: the former 17 local statistical offices were replaced by seven regional statistical bureaus. Until 1999, regional statistical bureaus were responsible for the production of official statistics. In 2000, the regional statistical bureaus were closed and the statistics agency became centralized.

Vital statistics cover demographic events of Estonian residents registered at the vital statistics offices in Estonia, as well as the vital events of Estonian citizens registered in the foreign representations of Estonia. Events registered in Estonia or in a foreign representation of Estonia are excluded from statistics if the place of residence of the person(s) is permanently abroad (<http://www.stat.ee/>).

Under the Soviet period, Estonian cause-of-death data were processed and tabulated according to the Soviet classifications (in total, four Soviet classifications were used: SC-1965, SC-1970, SC-1981 and SC-1988). In 1994, Estonia adopted the 9th revision of the WHO International Classification of Diseases (ICD) and, only three years later in 1997, the 10th ICD revision was implemented.

Population and birth count data were obtained from the Human Mortality Database (HMD). They, however, differ from HMD for infant deaths and births, where we applied our own corrections for infant death under-registration. The cause-specific data were obtained from Russian archives (for period 1959-1990) or from personal communication with Kalev Katus on the Estonian cause-of-death statistics (for period 1947-1988). Kalev Katus has also provided us with cause-specific data for period 1991-2000. From 2001 onwards, the cause-specific data were extracted from the WHO Mortality Database.¹

Territorial coverage

There were no territorial changes in Estonia during the period 1955-2012.

¹ http://www.who.int/healthinfo/statistics/mortality_rawdata/en/

Part I – Vital statistics and population censuses

1. Death count data

Coverage and completeness

Until 1993, statistics on deaths were based on death records of all deaths registered at the vital statistics offices of local governments. Starting from 1994, statistical accounting forms of registering deaths were used, which from 1996 were renamed medical death certificates. Medical death certificates also serve as the basis for preparing death records. The deaths of Estonian citizens whose place of residence is abroad and whose death is registered abroad are excluded. Also, deaths are excluded in the cases of foreign citizens who died in Estonia but whose place of residence was outside Estonia. In the case where the dead person's place of residence is unknown, the place where the death was registered is used as the last place of residence for the person concerned. From 2008 onwards, the data of the Population Register and Estonian Causes of Death Registry are used (<http://www.stat.ee/>). Data quality is further discussed on the HMD website, see: <http://www.mortality.org/hmd/EST/InputDB/ESTcom.pdf>

Specific details: infant mortality

Until the end of 1991, the definition of an infant death in Estonia differed from the one recommended by the WHO. Early neonatal deaths (i.e., those occurring within the first 7 days of life) were not registered if the birth weight was less than 1000 grams, the period of gestation was shorter than 28 weeks or the body length was shorter than 35 centimetres. Due to this restricted definition, a significant proportion of early neonatal (and total infant) deaths was under-reported. Since 1992, the WHO definition of an infant death has been used to register infant deaths. According to the WHO definition, a live birth is defined as any delivered child showing evidence of life (respiration and heartbeat).

Beyond HMD checks, we discovered non-negligible underestimation of infant mortality and decided to make appropriate corrections for the years before 1992. The first correction was applied to the years before 1974 in order to take into account the 1974 reform of the neonatal death certificate. The second correction was applied to the years before 1992 in order to take into account the 1992 adoption of the WHO definition of live birth. For more details, see: Katus Kalev, Jasilionis Domantas, Meslé France and Vallin Jacques in the forthcoming "Data collection and mortality estimates after World War 2", in Meslé France, Vallin Jacques, *et al.*, *Mortality and causes of death in the Baltic countries. Trends, patterns and differentials*.

2. Population count data

Coverage and completeness

Three population censuses (1959, 1970, and 1989) were organized in Estonia during the Soviet period (1940-1989). Two censuses (2000 and 2011) have been conducted since the restoration of Estonia's independence in 1990. In the two most recent censuses, however, significant population under-coverage was documented (Tiit, 2014). Additionally, due to long-term under-registration of international migration, the official intercensal population estimates are to be used with caution, especially for the period 1990-1999. The quality and the methodology of population estimates is discussed in more detail on the HMD website, see:

<http://www.mortality.org/hmd/EST/InputDB/ESTcom.pdf>

3. Birth count data

Coverage and completeness

Until 1993 the birth statistics were based on the birth records of all births registered at the vital statistics offices of counties and local governments. Starting from the beginning of 1994, the data are derived from statistical accounting records of birth registration, which are filled in when compiling the birth certificate. The basis for yearly processing of the birth data is the birth date of the child. Births

must be registered within one month after childbirth. Data quality is discussed on the HMD website, see: <http://www.mortality.org/hmd/EST/InputDB/ESTcom.pdf>

In order to account for a change in the definition of a live birth from 1992, we increased total birth counts before 1992 by the number of infant deaths added for under-registration.

Part II – Information on CoD collection

4. Death certificate

The systems of cause-of-death collection were different during Soviet times and after independence in 1991.

A) During the Soviet period

When a death occurred, the relatives of the deceased had to obtain a medical death certificate from the appropriate medical institution (hospital, polyclinic, or medical expert from the *Sudebno-Meditzinskaia Expertiza* (Forensic Bureau)) and to bring it to the civil registration office of the district (ZAGS). In that office, they were then given a death certificate that allowed them to bury the corpse and settle the inheritance. On its end, the ZAGS sent the medical death certificate to the central statistical bureau, which was in charge of coding causes and producing death statistics.

As in most countries, the medical death certificate distinguished three levels of causes of death: initial cause, direct cause and associated cause. Tabulations relied only on the initial (underlying) cause. Each year a standardized table (*forma n° 5*) gave the number of deaths by sex, age group and cause for at least the urban, rural and total population. The national tables were then centralized and totalized with those coming from other Soviet republics at the level of the whole Union by the USSR's GOSKOMSTAT. *Forma n° 5* is the main source of information on mortality used in our study.

B) After independence

After independence in 1991, new regulations were adopted for registration, coding and classification of causes of death. In the current system, each death must be declared by relatives of the deceased person or by anyone informed about the death, after requesting the necessary medical certificate from a medical doctor. A declaration must be made to the *Perekonnaseisuamet* (Civil Registration Office) within three days after the death. Such a declaration is a necessary condition for obtaining a burial certificate.

Every death certificate must include information on the cause of death, which is certified by a medical doctor. A new form was introduced in 1993. Both death certificate and cause-of-death information are transmitted to the Statistical Office, which is in charge of data processing and statistical exploitation. The coding process is centralized at the national level.

In 2008, the Estonian Causes of Death Registry was established at the Institute for Health Development. Data collection and part of the archives were transferred there from Statistics Estonia. Since then, the medical death certificate consists of four pages, of which the first contains medical information and is sent directly to the Causes of Death registry. The last page consists of socio-demographic data that is used for administrative registration. The second and third pages are provided to the relatives of the deceased and to the health care institution, respectively.

In cases requiring an autopsy, the medical death certificate is filled in by the forensic or hospital pathologist who performed it; thus, 100% of all autopsy results are used for certification and coding. As part of their obligatory training in pathological anatomy and forensic medicine, medical doctors are trained in certification before graduation. After graduation, guidelines and occasional training courses in certification are provided by the mortality data collection unit, frequently in co-operation with the Ministry of Social Affairs. Only medical doctors have been allowed to fill in medical death certificate

since 1994; before that, a small number of deaths were certified by an assistant physician (*feldscher*).

5. Cause-of-death coding

The codification of causes of death within the Soviet system was centralized at the republic level by the Estonian statistical office.

6. Classifications in use and collected data

6.1 Classification changes

The Soviet Union never used the *International Classification of Diseases, Injuries and Causes of Death* (ICD) of the World Health Organization (WHO), but instead relied on its own classification. This consisted of about 100 groups of causes until 1964 and was then expanded to about 200 items. Since the foundation of the USSR, seven different versions of the Soviet classification were successively in use, five of which were after WW2. The USSR health ministry and the GOSKOMSTAT were jointly responsible for any changes in the medical death certificate and in the rules for registration and codification², as well as for adopting successive revisions of the classification.

During the period studied here, which begins in 1955, four successive versions of the Soviet classification were used in the Baltic countries: those adopted in 1952, 1965, 1970, and 1981. Furthermore, two less important changes occurred in the meantime: in 1957, the 1952 version was slightly changed in regard to maternal deaths; and in 1988, the 1981 version was shortened by cancelling the distinction between work accidents and other accidents. After independence, the Soviet classification of causes of death remained in use for 2 years until the adoption of ICD-9 in 1993. Finally, it was decided to use ICD-10 after 1997.

Two peculiarities characterized the Soviet system of registering and classifying of causes of death, and they deserve additional comments:

1. In spite of some tendencies toward growing closer to each other, the Soviet classification always maintained important differences from the ICD. In particular, the number of items increasingly became much less than that of the ICD. While the number of items in the Soviet classification evolved from 100 to about 200 during the period of interest, that of the ICD grew from more than 2000 (ICD-7) to more than 5000 (ICD-9).

2. From 1964 to 1987, some items in the Soviet classification were excluded from the regular statistical tables (*forma 5*): corresponding causes (cholera, plague, suicide, homicide and work accidents) were kept secret for political reasons. To make sure the sum of deaths by cause fit with the total registered deaths, deaths attributed to these “hidden” causes were mixed with deaths of ill-defined or unknown causes. However, hidden causes were computed separately in a special top secret table (*forma 5b*). The reason why Soviet authorities decided to keep these causes of death secret is not a mystery: in 1970, for example, the age-standardized male mortality rate by homicide in the Soviet Union was eight times higher than the European average. The Soviet power preferred to prevent any internal or external observers from accessing such information, as it was considered too politically dangerous.

6.2 Collected data

Table 1 summarizes information about the data collected for the reconstruction.

² As far as we know, for the post-WW2 Soviet period, new rules were edicted in at least 1954, 1964, 1966, 1974, 1980, 1984, 1986, 1989.

Table 1. Overview of the collected data for Estonia

Period	Classification	Acronym	Number of items	Number of age groups	Age group format	Data type
1955-1964	4 th Soviet Classification	1952-SC	116	18	0 year, 0-27 days, 1-2 year, 3-4, 5-6, 7, 8-9, 10-14, 15, 16-17, 18-19, 20-24, 25-29, 30-39, 40-49, 50-59, 60-69, 70+ (and unknown age)	Paper
1965-1970	5 th Soviet Classification	1965-SC	210	23	0 year, 0-27 days, 1 year, 2, 3, 4, 5-9, 10-14, ..., 80-84, 85+ (and unknown age)	Paper
1970-1980	6 th Soviet Classification	1970-SC	185	23	0 year, 0-27 days, 1 year, 2, 3, 4, 5-9, 10-14, ..., 80-84, 85+ (and unknown age)	Paper, but electronic in 1971, 1976 and 1980
1981-1987	7 th Soviet Classification	1981-SC	185	23	0 year, 0-27 days, 1 year, 2, 3, 4, 5-9, 10-14, ..., 80-84, 85+ (and unknown age)	Electronic
1988-1993	7 th Soviet Classification, revised	1988-SC	175	23	0 year, 0-27 days, 1 year, 2, 3, 4, 5-9, 10-14, ..., 80-84, 85+ (and unknown age)	Electronic
1994-1996	9 th International Classification of Diseases	ICD-9	5,600	19	0 year, 1-4, 5-9, 10-14, ..., 80-84, 85+ (and unknown age)	Electronic
1997-2000	10 th International Classification of Diseases	ICD-10	>10,000	19	0 year, 1-4, 5-9, 10-14, ..., 80-84, 85+ (and unknown age)	Electronic
2001-2008	10 th International Classification of Diseases	ICD-10	>10,000	27	0 year, 0 day, 1-6 days, 7-27 days, 28-365 days, 1 year, 2, 3, 4, 5-9, 10-14, ..., 80-84, 85+ (and unknown age)	Electronic
2009	10 th International Classification of Diseases	ICD-10	>10,000	19	0 year, 1-4, 5-9, 10-14, ..., 80-84, 85+ (and unknown age)	Electronic
2010-2014	10 th International Classification of Diseases	ICD-10	>10,000	29	0 year, 0 day, 1-6 days, 7-27 days, 28-365 days, 1 year, 2, 3, 4, 5-9, 10-14, ..., 90-94, 95+ (and unknown age)	Electronic

6.3 Data sources

For period 1947-1988, the data were kindly provided in computerized files by Kalev Katus. Data for years 1959-1990 were gathered from the Russian State Economical Archives (RGPE).³ Data for years 1991- 2000 were also obtained from Kalev Katus, while data for year 2001-2012 were downloaded from the WHO mortality database. (http://www.who.int/healthinfo/mortality_data/en/).

6.4 Specific treatment of the raw data

For the years covered by ICD-9 (1994-1996) and by ICD-10 (since 1997), data were available at least at the 4-digit level; but taking into account the small number of deaths, the reconstructions between these two classifications and between ICD-9 and the last Soviet classification were performed on the basis of abridged lists (214 groups of items for ICD-9 and 211 for ICD-10) (see Annex).

Deaths of unknown age were redistributed among each cause of death proportionally to deaths of known age.

Estimated non-registered infant deaths were redistributed proportionally within perinatal causes and congenital anomalies (items P00-Q99 in ICD-10).

7. Specific transition documents

No documents related to the transition were produced by the statistical office. No double coding was used in the years of transition.

Part III – Reconstruction information

8. Reconstruction of coherent time series

A total of six transitions were carried out, while the available death statistics by cause were regulated successively by seven classifications. The overview of the transitions is given in Table 2. Elementary associations and transitions coefficients are available upon request.

Table 2. Elementary associations by type and transition

Transitions	Type of associations				
	1 :1	1 :N	N :1	N :N	Total
From 1952-SC to 1965-SC	24	6	0	27	57
From 1965-SC to 1970-SC	89	4	11	26	130
From 1970-SC to 1981-SC	128	4	5	11	148
From 1981-SC to 1988-SC	165	0	7	2	174
From 1988-SC to ICD-9	124	15	2	14	155
From ICD-9 to ICD-10	168	4	0	14	186

³ Fund n° 1562 : opus 27 (ed. 833, 1023, 1187, 1328, 1464, 2632, 2638, 2655-2658, 5873, 5874, 5881, 9742, 9743, 9752, 9753), opus 33 (ed. 980, 1361, 1700, 6627, 6984, 7320, 7652, 7933), opus 34C (ed. 174, 356, 529, 701, 882), opus 44 (ed. 2625, 2655-2658), opus 45 (ed. 2368, 2369, 5873, 5874, 5881, 9742, 9743, 9752, 9753), opus 46 (ed. 1587, 1588, 1595, 1596), opus 47 (ed. 1430, 1431, 1438, 1439), opus 48 (ed. 1289, 1290, 1299, 1300), opus 49 (ed. 1859-1860, 1869-1871), opus 50 (ed. 1758, 1759, 1768-1770), opus 55 (ed. 1908, 1909), opus 56 (ed. 1936, 1937, 1947, 1948).

Specific problems

For the transition between 1952-SC and 1965-SC, four specific problems were encountered:

- 1) The period covered by 1965-SC (5 years 1965-1969) was too short, which made checking the results more difficult. The solution was to base the work on Russian data.
- 2) The number of items was much lower in 1952-SC (116) than in 1965-SC (210). It was found to be advantageous if we reconstructed the total death series first in the reverse direction (redistributing 1965-SC deaths into 1952-SC items) and then in the correct direction (redistributing 1952-SC deaths into 1965-SC items) automatically by age and sex.
- 3) The 1965-SC was not applied fully in 1965 but in 1966. These 1965 anomalies were treated by *a posteriori* corrections.
- 4) The 1952-SC was modified slightly in 1957 (item 110 was suppressed and items 108 and 109 were slightly reshaped). The solution here was not to treat it as the set of a new classification, but to instead just adjust 108 and 109 for the previous years and drop 110.

For the transition between 1965-SC and 1970-SC, no major specific problem occurred. The period covered by 1965-SC is short (5 years), but the Soviet classification grew increasingly closer to the ICD while the number of Soviet items was diminishing (from 211 to 185). This, however, did not represent any great difficulty, as the number of complex associations was low.

For the transition between 1970-SC and 1981-SC again, no particular difficulty was encountered.

Between 1981-SC and 1988-SC, the classification changes were limited to external causes. Most of them were just merged (the number of items dropped from 185 to 175), but some were more complex and required applying the regular process of reconstruction.

For the transition between 1988-SC and ICD-9, two specific problems occurred:

- 1) Moving from 175 items (1988-SC) to about 5600 items (ICD-9) while dealing with very small numbers of deaths. As a solution, we worked with a list of ICD-9 items reduced to 214 groups. These groups were built on the basis of 3-digit ICD-9 items, except in one case that concerned heart diseases, which required the 4-digit detail in order to fit with the “intermediate” list of 107 causes common to all countries of the MODICOD project.
- 2) The period covered by 1988-SC was too short (1988-1993) to check the continuity of the results efficiently. However, the problem was limited to external causes. The trends were reconstructed for almost all causes and were then re-checked for external causes when the 1981-1997 data were reclassified into 1988-SC.

The transition between ICD-9 and ICD-10 represented no specific problem. As for ICD-9, thousands of ICD-10 items were grouped into an abridged list (211 groups) that was compatible with the intermediate list of 107 items proposed for the MODICOD project.

A posteriori corrections

A posteriori corrections were applied for year 1965, when an incorrect transition to a new revision took place. At the end of the reconstruction process, total deaths by age groups were adjusted to fit with HMD data (from 1959), except at age 0 before 1992 (to take into account the correction of infant deaths for under-registration).

9. Redistribution of ill-defined causes of death

Ill-defined causes of death were redistributed proportionally among other causes of death and accidents for the whole period.

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List of acronyms

GOSKOMSTAT - Central Statistical Office of the USSR

RGPE - Russian State Economical Archives

ZAGS - *Zapis' aktov grazhdanskogo sostoiania*, Registry of Acts of Civil Status

MODICOD - Mortality Divergence and Causes of Death