About Russia Data on Causes of Death

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General

Currently the Federal State Statistics Service of Russian Federation (Rosstat) is responsible for collecting and publishing data on vital statistics in Russia. This agency is also charged with the responsibility of carrying out population censuses and providing population estimates in the intercensal period. The history of Statistics Service in Russia starts in 1802, when the Minister of Interior of the Russian Empire issued a circular decreeing the governors to submit statistical institutions. The Statistical Department was established under the Police Ministry in 1811, and since 1823 it has been under the Ministry of the Interior. Between 1918 and 1990 the Statistical Service of Russia was accountable to the Central Statistics Board the USSR. In 1991, after the dissolution of the Soviet Union, the Goskomstat (Gosudarstvennyi Komitet Statistiki) of Russia became an independent agency; in 2004 it was renamed as the Federal State Statistics Service.

Each region of Russia has its own Statistics Service which is responsible for collecting and processing data on vital statistics in the region and providing these data to Rosstat. Rosstat collects all data reported by the regional statistics services and processes them in order to create country-level statistics. Then, data on regional and national vital statistics, such as birth and death counts, population estimates and certain demographic indicators are published by Rosstat on their webpage (http://www.gks.ru/wps/wcm/connect/rosstat_main/rosstat/ru/statistics/population/demography/), in annual population yearbooks, and also in the Unified Interdepartmental Statistical Information System (https://www.fedstat.ru/indicators/start.do). However, the most detailed data (e.g. age-specific death counts by cause) are not available online and are provided by Rosstat only upon special request.

Between 1965 and 1998, several Soviet classifications of causes of death were in use in Russia. In 1996 the reconstruction of Russian cause-specific mortality series was performed by F. Meslé, V.M. Shkolnikov, V. Hertrich and J. Vallin (Meslé et al. 1996). The series since 1965 were reconstructed in accordance with the last Soviet Classification (SC-1988). Due to that laborious work which had required several sequent recalculations of death counts from one classification to another, the coherent series by causes of death became available for Russia for the period from 1965 to 1998. The series obtained through that reconstruction procedure were (and still are) widely used by researchers for analyzing long-term trends of Russian mortality by causes of death. In 2003 these series were extended backwards to 1956 (Meslé et al. 2003). However, the series for the period 1956-1964 still require some additional corrections and for this reason the current reconstruction procedure was based on the series starting from 1965.

The year 1999 marked a new break in Russian cause-specific mortality series, because Russia implemented the Russian Abridged Classification based on the 10th Revision of International Classification of Diseases (ICD10). Therefore a new reconstruction procedure was needed to assure the comparability with mortality data coded in previous revisions. Moreover, the Russian Abridged Classification has been modified several times since 1999. All the series in the Human Cause-of-Death Database (HCD) are provided according to the classification that was in use between 2006 and 2010. The reconstruction procedure was performed based on the methodology and the results of the previous reconstruction (Meslé et al. 1996).

Territorial coverage

A few changes in the territorial coverage of vital statistics took place in Russia during the period covered by the HCD data. During 1993-1994 in the Ingush Republic and during 1993-2002 in the Chechen Republic the registration of vital events was fragmentary and deaths and births in these regions were temporarily excluded from national statistics. Birth and death counts in the Ingush Republic have been re-included into national statistics since 1995, and since 2003 in the Chechen Republic. However in 2003 information about the causes of death in the Chechen Republic was still not available, and only data on all-cause mortality were reported by this region. Cause-specific mortality data is therefore available for the Chechen Republic only since 2004. Thus, for the period 1993-2003, the HCD data does not refer to the entire population of Russia. Despite the fact that the vital registration in 1993-2002 did not cover the whole territory of Russia, Rosstat still included population of the Chechen and Ingush Republics into the national population estimates. Due to this statistical inconsistency, we are using here the population estimates from the Human Mortality Database (HMD) where the Russian population estimates are already corrected by excluding the population of the Ingush Republic (1993-1994) and the Chechen Republic (1993-2002). However as HMD provides population for year 2003 for Russia as a whole, and while we do not have data on cause-specific death counts for this year in the Chechen Republic, we excluded the Chechen Republic from the population for this year in order to avoid inconsistency between numerator and denominator in cause-specific mortality rates. We should also note here that population of the Chechen and Ingush Republics together comprise only about 1% of the whole population of Russia.

Part 0 – vital registration

1. Death count data

Coverage and completeness

All medical death certificates issued by the responsible authorities (medical organizations or private physicians) in Russia should be registered within 3 days in the district offices of the Registration of Acts of Civil Status (ZAGS), a government body that is responsible for the civil registration of deaths in Russia. The district offices of ZAGS submit the medical death certificates to the Regional Statistics Services, where information on death is registered and then transferred to the statistical databases. Thus, death registration in Russia is based on *de facto* population. The death registration coverage in Russia is

estimated as complete, with 100% deaths covered by the vital registration system (Mathers et al. 2005). As mentioned before, between 1993 and 2002 registered deaths do not include certain territories of Russia (see section "Territorial coverage").

Specific details: infant mortality

Regarding infant mortality, under-reporting issues have been observed arising from discrepancies between the Russian and the WHO definitions of live births. According to the WHO, live birth is a *"the complete expulsion or extraction from its mother of a product of conception, irrespective of the duration of the pregnancy, which, after such separation, breathes or shows any other evidence of life (e.g. beating of the heart, pulsation of the umbilical cord or definite movement of voluntary muscles - whether or not the umbilical cord has been cut….)"*. There is no restriction of weight, length, or the gestational age of newborn in the WHO definition.

The Russian definition of live births has changed several times since 1965. Before 1993 the Soviet definition was used in Russia, according to which breathing was sufficient to consider the birth was a live birth. Furthermore only children born after 28 weeks of gestation, weighing 1000 g or more, and having a body length of no less than 35 cm could be counted as having been born alive. Newborns not fitting these criteria were considered to be live-born only if they survived 168 hours and longer after the birth. In 1993 this criteria was extended slightly. First, newborns who did not breathe but instead had other signs of life, such as beating of the heart, pulsation of the umbilical cord or movement of voluntary muscles, started to be counted as being alive. Next, the weight criterion was lowered to 500 g in case of multiple births.

In 2012 Russia adopted a new definition of live birth which is much closer to the recommended WHO standards (Kvasha, 2014). The adoption of new rules caused an increase of infant mortality rates in 2012 of 16% compared to the level of 2011. Neonatal mortality had increased even more – by 30.5%. Moreover, the decree implementing the new definition of live- and stillbirths was officially published only in April 2012, and therefore, the increase of infant mortality would probably have been even higher if the new definition had been implemented at the beginning of the year (Andreev, Kvasha 2013).

The new definition of live births implemented in 2012 however still differs from the WHO standard. According to the Russian definition of 2012, live birth is *"the moment when the fetus is separated from the mother's body by means of childbirth at a gestation of 22 weeks or more and the newborn's weight is 500 g or more (or less than 500 g in the case of multiple births), or, if the child's weight at birth is unknown, with a body length of 25 cm or more, and with signs of live birth (breathing, beating of the heart, pulsation of the umbilical cord or definite movement of voluntary muscles – whether or not the umbilical cord has been cut or the placenta is attached)"*. If the newborn's weight is less than 500g or gestational age is less than 22 weeks, it is regarded as live birth only if the newborn survives 168 hours (7 days) after the birth. The extremely immature newborns with the highest mortality risk are therefore still not counted neither as live births nor as infant deaths.

The above described rises in infant mortality were caused by documented changes in live birth definitions. Besides, some influence of changes in registration could also take place between 1983 and 1985 as neonatal mortality rates unexpectedly increased in this period. In 1984, the Soviet Ministry of

Health published new instruction on the registration and reporting deaths in the perinatal period (Order 1300, November 19, 1984). Though that instruction did not change the definition of live birth, it could result in better registration of neonatal mortality.

Thus we applied three corrections for infant mortality underestimation in order to assure the comparability of series in time (Figure 1) and to conform to current registration practice. The correction between 1983 and 1985 was already done during the previous reconstruction of mortality series for Russia (Meslé et al. 2003). By that time it was decided not to make any corrections between 1992 and 1993 as the rise in neonatal mortality was insignificant between these years (Andreev, 1995). During the current reconstruction, we had carefully re-examined the causes of death contributed to that small increase in neonatal mortality and came to the conclusion that - at least partly - that increase was caused by the change of live birth definition that took place in 1993. So we have slightly adjusted the series for this period as well. However, compared to the adjustments before 1985 and 2012, the adjustment between 1992 and 1993 was minor (Figure 2).

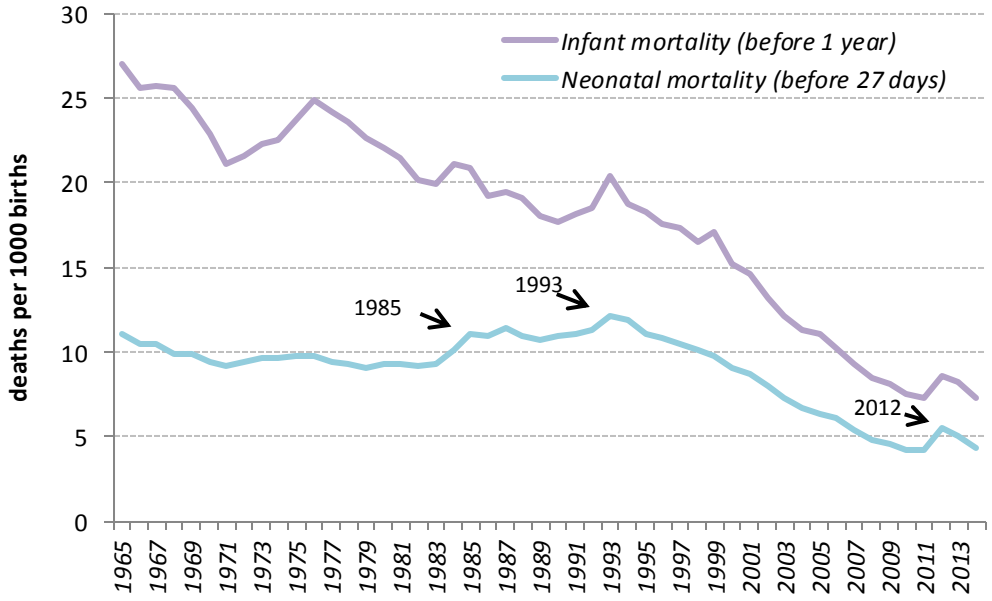


Figure 1. Neonatal and infant mortality in Russia, both sexes, 1965-2014

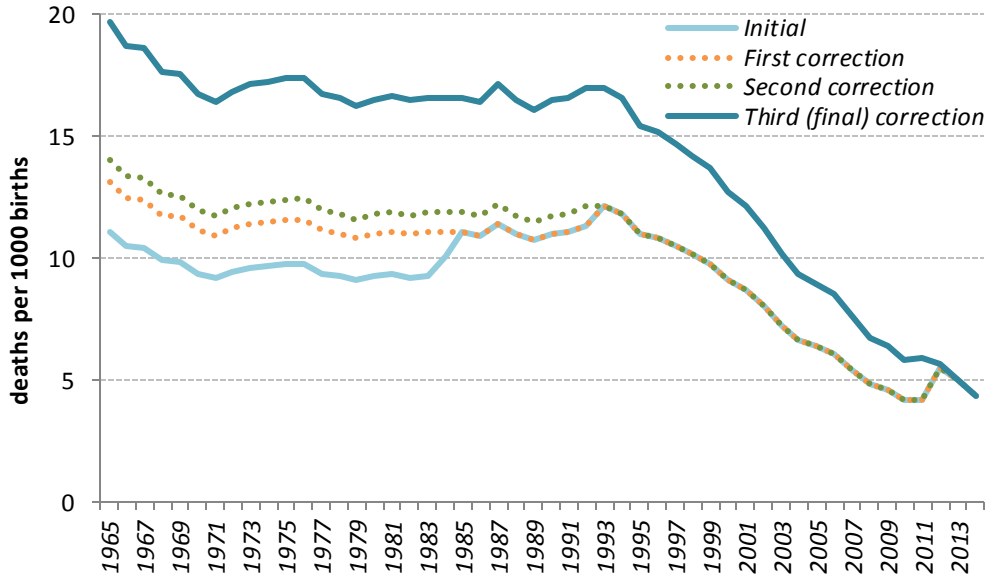


Figure 2. Corrections of neonatal mortality

After correcting the neonatal mortality we calculated the number of "additional" (unreported) infant deaths and the number of births that were previously regarded as stillbirths.

2. Population count data

Coverage and completeness

Population estimates for the period 1965-2014 are based on the all-Soviet censuses that took place in 1959, 1970, 1979, 1989 and the Russian censuses of 2002 and 2010. During the Soviet period both *de facto* and *de jure* population were registered in the censuses. The difference between *de facto* and *de jure* population, however, was very small. The *de facto* population of Russia was only 0.1-0.2% higher than the *de jure* population. The Russian censuses of 2002 and 2010 operated with the *de jure* population only, i.e. individuals were recorded on the basis of the place of their usual residence. The concept "place of usual residence", however, was different in the Soviet censuses and the censuses held in Russia in the post-Soviet period. While in Soviet censuses temporarily absent individuals were counted as *de jure* population if they were absent for less than 6 months, in Russian censuses this period was extended to 1 year. Thus, in the censuses of 2002 and 2010 all individuals who were temporarily absent for a period of less than 1 year were recorded as "permanently living" (individuals who had left the country for tourism, for treatment, or to visit relatives and friends were recorded, even if they were absent for more than 1 year). Respectively, all individuals who were living in Russia for at least 1 year were counted in the censuses as Russian inhabitants.

For population counts at advanced ages, just as for death counts at these ages, there is a problem of age heaping and age overstatement and a particular problem of over-registration of centenarians (see the Background & documentation file for Russia in the HMD for more information).

The HCD population estimates were taken from the Human Mortality Database (www.mortality.org). Population estimates for the year 2003 were corrected by excluding the Chechen Republic (see "Territorial coverage" section above).

3. Birth count data

Coverage and completeness

After a birth, the medical birth certificate is to be exchanged for a civil birth certificate in any of the ZAGS office. The offices of ZAGS then pass the medical birth certificates to the Regional Statistics Services where information on the birth is registered and then transferred to the statistical databases. All births occurring within the country should be registered, regardless of the residence of parents. Thus, similar to deaths, birth registration in Russia is based on *de facto* population. Birth counts between 1993 and 2003 do not include certain territories (see section "Territorial coverage").

Specific details

Since 1965 the Russian definition of live births had been changed a few times. To adjust data for these changes we have added to initially registered births the additional infant deaths estimated from the corrections of infant mortality (see „Specific details: infant mortality" in the section "Death count data" above).

Part I – information on CoD coding

4. Death certificate

There are two types of medical death certificates in Russia: a regular “medical death certificate" that is issued for cases of death in adults or children older than 7 days, and a medical certificate of perinatal death that is issued in cases of early neonatal death (up to 7 days).

The medical death certificate contains two separate parts (Annex 1). After completion, the first part is left in the medical organization that issued the medical death certificate. The second part is given to the deceased’s relatives (or other person responsible for declaring the death) and is to be submitted to the district office of ZAGS within three days, where the medical death certificate will be exchanged for a civil one. A civil death certificate is needed for burial and for other legal purposes.

The medical death certificate should be issued within 24 hours after autopsy or after formulating a final diagnosis in cases where the body was not subjected to an autopsy. The doctor issuing the medical death certificate should specify whether this certificate is “preliminary”, “final”, “instead of preliminary” or “instead of final”. The preliminary certificate is issued in case the medical or law enforcement investigation is incomplete and further examinations are needed to specify the final diagnosis. After the final diagnosis is established, a new certificate (“instead of preliminary”) should be issued and transmitted to the district office of ZAGS and then to Rosstat within 45 days (7 days in case of infectious diseases). The preliminary cause of death should be replaced by a final one. In case a mistake was revealed after issuing the final death certificate and the diagnosis had been changed, the new certificate (“instead of final”) should be issued and the old final death certificate should also be replaced with a the new one.by the new one. However, the question remains whether the preliminary causes of death are always replaced by the final ones in the statistics (Gavrilova et al. 2008).

Both parts of medical death certificate include a “cause-of-death” section. As recommended by WHO the “cause-of-death” section is split into two parts. The first part has four lines where a sequence of causes leading to death should be written. But while according to WHO recommendations there are no restrictions in using all the lines to specify the morbid sequence leading to death, according to the Russian standards the fourth line can be used only in case of external causes. In all other cases the sequence of causes should be limited to 3 lines. For all causes of death, the approximate time between the beginning of the pathological process and the death should be specified.

In the second part of the “cause-of-death” section, all important conditions that had contributed to death but were not a part of main causal sequence leading to death should be reported. The certifiers are also asked to provide a 4-digit ICD10 code for the underlying cause of death (they can specify the ICD10 codes for all other causes as well, but only the encoding of the underlying cause is compulsory).

Besides the causes of death, both parts of the medical death certificate contain information about the deceased (name, sex, date of birth, place of residence) and circumstances surrounding the death (place of death, did the death occur within 7 or 30 days in case of road accident, did the death occur to a pregnant woman). The second part of medical death certificate (to be transmitted to the office of ZAGS) also contains information on how the cause of death was diagnosed (who diagnosed the cause of death, on which basis it was made), was the death caused by a disease or by an external cause, and additional socio-demographic information about the deceased (marital status, education, occupation).

A different form of death certificate is used when a newborn dies within the first 7 days. In this case a "medical certificate of perinatal death" is issued (Annex 2). This certificate is also used in case of stillbirths. Like the normal medical death certificate, the medical death certificate of perinatal death contains two separate parts, each of which has a section about the causes of death. The main peculiarity of the perinatal medical death certificate is that it contains information both about the newborn (fetus) and the mother.

The death certificates can be filled in by a doctor (physician or pathologist) or - in the absence of a doctor - by a feldsher (in USSR and now in Russia feldshers stand midway between doctors and nurses with respect to medical liabilities, in rural areas feldshers provide primary care services as the physicians). Feldshers are not allowed to issue medical death certificates in case of perinatal, maternal death or a death caused by external causes (these deaths are subject to autopsy). Both manual and computer assisted certification are allowed.

5. Coding system

The cause-of-death coding is performed at the same time the medical death certificate is filled in. While specifying the sequence of causes that contributed to death, medical practitioners should follow the ICD rules to place the causes of death in the correct order and to code these with the appropriate ICD10 codes. Such practice was adopted only in 1999 when ICD10 was introduced in Russia. Before 1999 certifying practitioners filled in the medical death certificate by reporting the sequence of causes of death as text, but they did not code it. The coding procedure was performed later in regional statistical offices where trained statisticians (coders) were responsible for coding the causes of death and selecting the underlying cause of death based on the information reported on medical death certificates. They coded the causes of death in accordance with the current revision of the Soviet Abridged Classification. Since the responsibility of coding was transmitted to medical practitioners, the statisticians are responsible only for checking the ICD codes for obvious mistakes, and for aggregating these codes into the items of Russian Abridged Classification.

There is no centralized and/or automated coding system in Russia to assist the medical professionals in selecting and coding the underlying causes, although the medical organizations in some regions do use software with a built-in ACME (Automatic Classification of Medical Entry) module (Vaysman, 2015).

6. Specific details of ICD revisions and collected data

Prior to 1999 the detailed International Classification of Diseases (ICD) was not used in Russia. Instead, the Central Statistical Office of the USSR developed abridged Soviet Classifications that were roughly based on contemporary revisions of the ICD. The Classification of 1981, which was modified in 1988 (SC-

1988), was the last Soviet Classification, and was in use until 1998. The list of all classifications used in Russia since 1965 is provided in Table 1.

Table 1. Cause-of-Death (CoD) Classifications Used in Russia since 1965

Period in use	Name	Number of items
1965–1969	Soviet Classification of 1965 based on the ICD–7 (SC–1965)	210+13*
1970–1980	Soviet Classification of 1970 based on the ICD–8 (SC–1970)	185+10*
1981–1987	Soviet Classification of 1981 based on the ICD–9 (SC–1981)	185+10*
1988–1998	Soviet Classification of 1981 modified in 1988 (SC–1988)	175+10*
1999-2005	Russian Abridged Classification of 1999 based on the ICD–10 (RC–1999)	235(236)**+10*
2006-2010	Russian Abridged Classification of 1999 based on the ICD10 modified in 2006 (RC–2006)	239+10*
since 2011	Russian Abridged Classification of 1999 based on the ICD10 modified in 2011 (RC–2011)	295+10*

Note: *extra items used to classify the external causes of death by character of trauma

** in 2004 "Terrorism" was introduced as a new item

In 1999, Russia implemented the ICD10. Along with the classification change, an important change in the coding practice was introduced: the task of assigning the alphanumeric ICD10 codes and of selecting the underlying cause of death has been forwarded to certifying practitioners. Even though all medical death certificates have four-digit ICD10 codes indicating (at least) the underlying cause of death, data at this level of detail are not published. The Russian State Statistics Service (Rosstat) provides information on causes of death in aggregate form only. In the aggregated data tables, deaths are tabulated in accordance with the Russian Abridged Classification. The Russian Abridged Classification used in between 2006 and 2010 (RC-2006) is provided in Annex 3.

In 2011, a new abridged classification was introduced by the Rosstat (RC-2011). However, all HCD series for Russia are provided in accordance with the RC-2006.

Regional disparities in ICD10 implementation

While starting to work on the reconstruction of coherent series for Russia, we have discovered that though the ICD10 (and the associated Russian Abridged Classification) were officially introduced in 1999, in reality 4 regions of Russia had postponed the transition for 1-3 years.

The RC-1999 comprised 245 items, in comparison with 185 items of the SC-1988. In many cases the additional ("new") items in the RC-1999 appeared due to the splitting some groups of causes from SC-1988 into more precise categories. Table 2 presents an example of such a splitting of one item of SC-1988 into three items of RC-1999. SC-1988 item "Cancers of urinary organs" was substituted in RC-1999

by three more detailed items: “Cancer of kidney”, “Cancer of bladder” and “Cancer of other and unspecified urinary organs”.

Table 2. An example of correspondences between items of the Soviet Classification of 1981 modified in 1988 (SC-1988) and the Russian Abridged Classification of 1999 (RC-1999)

SC-1988		RC-1999	
63	Cancer of urinary organs	79	Cancer of kidney, except renal pelvis
		80	Cancer of bladder
		81	Cancer of other and unspecified urinary organs

When we started to inspect national cause-specific mortality trends in order to align two classifications, we found that a few years after the transition there was an obvious interchange between the causes of death that were previously combined in one item of SC-1988. So, in the example of urinary cancers given above, the number of deaths attributed to “Cancer of other and unspecified organs” steeply decreased between 1999 and 2002 by more than 90% (from 2287 deaths in 1999 to 184 deaths in 2002), while deaths due to “Cancer of kidney, except renal pelvis” and to “Cancer of bladder” had increased inversely. Such significant shifts in cancer mortality are clearly suspicious, while cancer mortality tends to change smoothly and no rapid changes in trends can be expected. Figure 3 illustrates the trends in deaths from urinary cancers in Russia for the period from 1992 to 2012.

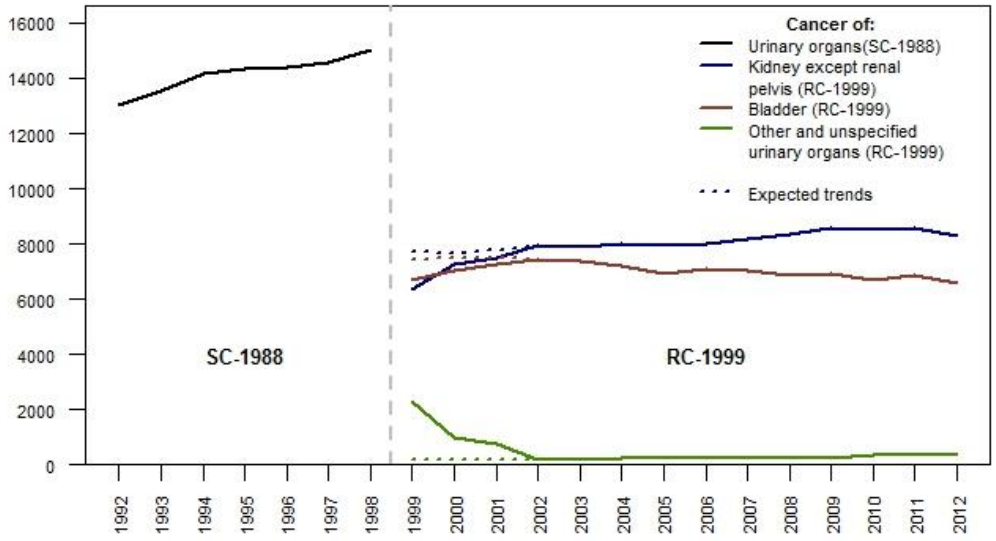
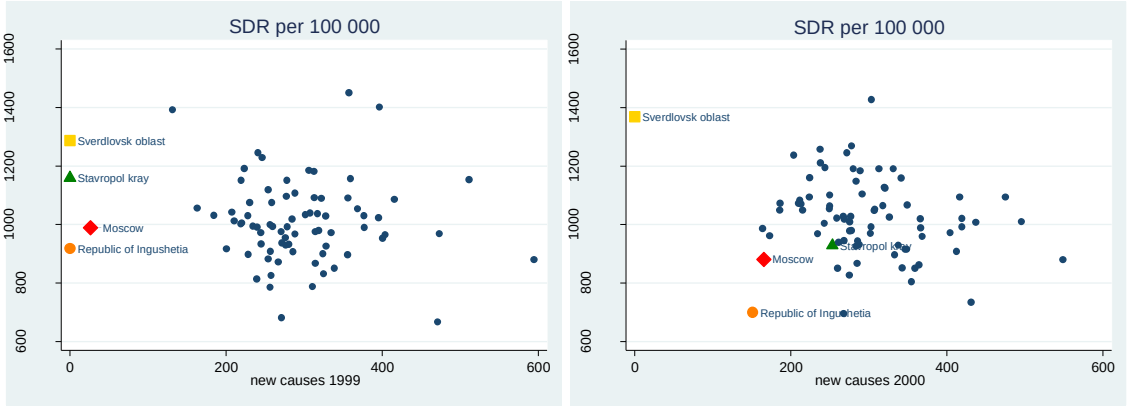


Figure 3. Death counts for cancers of urinary organs, Russia, both sexes

Note: Dotted lines indicate trends that could be expected (extrapolation of the trends 2002-2012 for three years backward).

In search for an explanation for this anomaly, we inspected regional cause-specific time-series and found that four regions (the city Moscow, Sverdlovsk oblast, Stavropol kray, and Republic Ingushetia) were responsible for 95% of aforementioned distortions. An in-depth examination of the cause-specific mortality data in these regions suggested that these regions have adopted the ICD10 later than the rest of Russia. This hypothesis was confirmed when we looked into the set of diagnoses that were used by regions for coding the underlying cause of death.

Regarding our earlier example, we found that in 1999 all deaths from cancers of urinary organs were coded in Sverdlovsk, Ingushetia and Stavropol under the item "Cancer of other and unspecified urinary organs", and in the city of Moscow[1] 87% of all cancers of urinary organs were coded under the same item. At the same time in other regions this share was 3% on average (with the largest share of 18% in Pskov). The same pattern appeared in the four exceptional regions for all causes of death that were not present in SC-1988. Clearly, in 1999 three regions mentioned above did not use the "new" items for coding the underlying cause of death at all and the city of Moscow did so very rarely (for coding 2.6% of all deaths). In the rest of the country, the share of "new" items in the overall mortality structure amounted to 22.8% on average (Figure 4). Items of the Russian Abridged Classification (RC-1999) divided into "new" and "old" items are provided in Annex 4.



[1] It seems that while the vast majority of institutions responsible for death coding in Moscow ignored the new rules, a few of them had started to use RC-1999 in 1999 as it was prescribed by the decree of the Ministry of Health

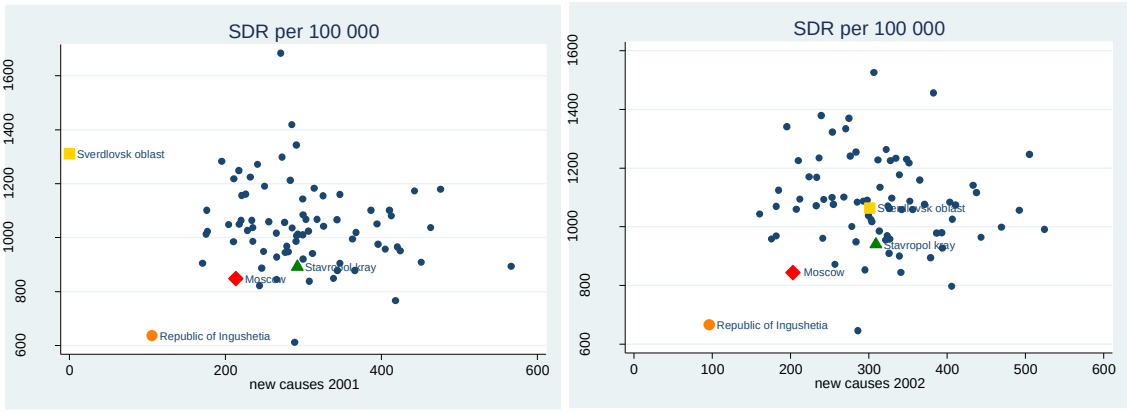


Figure 4. The ratio of standardized death rates from "new" and "old" items in Russian Abridged Classification of 1999 (RC-1999) in 83 Russian regions between 1999 and 2002

Hence, three regions: the city of Moscow, Stavropol, and Ingushetia postponed the transition by one year, and Sverdlovsk was ignoring the new rules of coding until 2002. Although all deaths in the regions mentioned above were formally published in the official statistics under the new RC-1999 beginning in the first year after the transition (1999), it is clear that in these four regions deaths were originally coded under the old SC-1988 and then translated in a rough way into the items of the new RC-1999 classification. Thus in four regions, even though the data have been published since 1999 under the RC-1999, the underlying cause of death in the very first years after the transition was actually selected and processed according to the previous SC-1988 classification. Moreover, because in 1999 these four regions made up 12% of the overall Russian population, the postponement of the transition just by those regions resulted in important discontinuities in the national cause-specific mortality series. We treated this issue by splitting the reconstruction process into several region-specific stages (see section "Reconstruction information" in Part II for more details).

7. Additional transition documents

No documents providing information about the transition between the Soviet classification and the ICD10 were available for the reconstruction.

Part II – reconstruction information

8. Specific treatment of the raw data

Transition-related issues

The raw data were corrected mainly for the issues related to the problematic transition to ICD10 in Russia. While all cause-specific death counts have been published by Rosstat according to the Russian Abridged Classification since 1999, in reality for the first 3 years these statistics were partly fictitiously transformed from the previous Soviet classification as some regions postponed the transition to the new classification for up to 3 years (see section "Specific details of ICD revisions" in Part I for more details). The first correction thus concerned only the four problematic regions. We adjusted the series for this problem performing a set of separate reconstructions for different territories at different time points (see section "Reconstruction information"). As a consequence, the data for the years 1999-2001 provided in the HCD is different from those officially published by Rosstat.

The ICD10 transition problem however did not concern only the four regions mentioned above. Regarding other Russian regions, though in the majority of them the ICD10 was introduced in 1999 (as it was prescribed by the Russian Ministry of Health), for some causes of death it took time for the new coding practices to become fully established, as the certifying practitioners had to gain an understanding of the new principles of selecting the underlying cause of death. Figure 5 presents the trends for three causes of death within the association for neoplasms of urinary organs for Russia without the four problematic regions mentioned before. In 1999 the number of death coded under the item "Malignant neoplasms of other and unspecified urinary organs" was more than twice as high as a year later, so the mortality trend for this cause had stabilized in 2000 only. In such cases as the reference data we used the death counts of the first year of a regular (stabilized) trend (year 2000 in the given example). Death counts between the year when the new classification was *de facto* implemented and year 1999 were estimated by applying cause-specific shares observed within the association for the reference year.

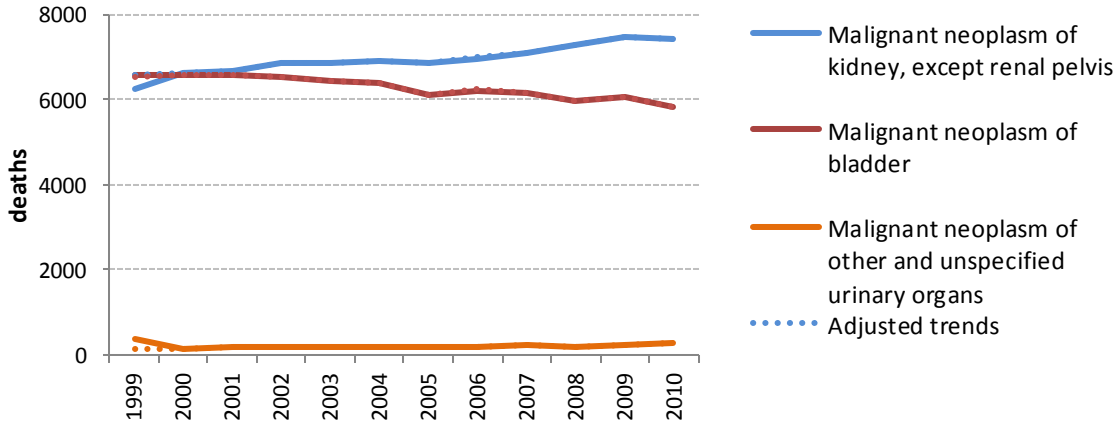


Figure 5. Death counts for cancers of urinary organs, Russia, excluding the 4 regions with postponed transition, both sexes.

Note: Solid lines indicate death counts published by official statistics; dotted lines indicate deaths counts obtained after the reconstruction (adjusted for later establishment of new coding practices).

Creating the HCD intermediate list

The Russian Abridged Classification (RC-2006) cannot be easily transformed into the HCD intermediate list. Some items of the RC-2006 aggregate ICD10 codes which correspond to more than one item of the HCD intermediate list. Fortunately, Evgeny Andreev has provided us with unpublished Rosstat data where all deaths are tabulated with the original 4-digit ICD10 codes. Thus, we managed to aggregate deaths since 2002 (the first year when ICD10 was de facto implemented in the entire territory of Russia) in accordance with the HCD intermediate list directly from these data. To extend the series backwards we had calculated special transition coefficients between the Russian Abridged Classification and the HCD intermediate list and applied these coefficients for the period 1965-2001 in order to transform the series coded in RC-2006 into the HCD intermediate list.

9. Reconstruction information

1. We produced transition coefficients for all of Russia without the four problematic regions and reclassified the deaths from 1992 to 1998 into RC-1999, in order to get coherent time series for the period from 1992 to 2005 (we started from 1992 as this was the first year when the inner administrative-territorial division of Russia was established in its present form).
2. In the excluded regions we preliminary reclassified death counts in accordance with SC-1988 between year 1999 and the year when ICD-10 was de facto implemented.
3. For the city of Moscow (separately) and for Stavropol kray and the Ingush Republic (both regions together) we performed specific reconstruction procedures between years 1999 and 2000; for Sverdlovsk obl. a specific reconstruction was performed between the years 2001 and 2002.
4. We summed up the series reconstructed for 4 different territories (1 – regions introduced ICD-10 in 1999 (all together); 2 – the city of Moscow; 3 – Stavropol kray and the Ingush Republic (together); 4 – Sverdlovsk obl.). Thus we obtained the coherent series for Russia as a whole coded in Russian Abridged Classification (RC-1999) for the period from 1992 to 2005.
5. As regional death counts in accordance with the present administrative-territorial division of Russia are available only since 1992, we did not have an opportunity to perform the reconstruction separately for different territories before 1992. Thus, to extend our series back before 1992 we performed an additional reconstruction for Russia as a whole using death counts for the year 1991 (initially coded in SC-1988) and death counts for the year 1992 (re-coded in RC-1999 after taking the previous steps) as the reference data. Doing this we got the coherent cause-specific mortality series for Russia from 1965 to 2005.
6. We created an additional elementary association for transport accidents between the years 2005 and 2006 to bring the series in accordance with the RC-2006.
7. The series coded after 2011 were recalculated into the RC-2006 by combining the causes that constituted the single item in RC-2006 and were split into several separate items in 2011.

Thus, to perform the reconstruction of cause-specific mortality series for Russia between the years 1998 and 1999 we in fact had to perform a few separate reconstruction procedures to take into account the delayed implementations of the new classification in a few regions of Russia. The overview of the accomplished reconstructions is given below:

1. ***Reconstruction for Russia without the 4 problematic regions between 1998 and 1999***
   112 fundamental associations were constructed to transform 185 items of SC-1988 into 235 items of RC-1999 (Annex 5) including:
   75 associations with 1:1 link (one item of SC-1988 corresponds to 1 item of RC-1999)
   1 association with n:1 link (n items of SC-1988 correspond to 1 item of RC-1999)
   8 associations with 1:N link (one item of SC-1988 corresponds to N items of RC-1999)
   28 association with n:N link (n items of RC-1988 correspond to N items of RC-1999)
2. ***Reconstruction for the city of Moscow between 1999 and 2000***
   138 fundamental associations (Annex 6) were constructed including:
   97 associations with 1:1 link
   0 associations with n:1 link
   18 associations with 1:N link
   23 associations with n:N link
3. ***Reconstruction for Stavropol kray and the Ingush Rep. between 1999 and 2000***
   130 fundamental associations (Annex 7) were constructed including:
   91 fundamental associations with 1:1 link
   1 fundamental associations with n:1
   16 fundamental associations with 1:N link
   22 fundamental associations with n:N link
4. ***Reconstruction for Sverdlovsk obl. between 2001 and 2002***

   135 fundamental associations (Annex 8) were constructed including:

   95 fundamental associations with 1:1 link

   1 fundamental associations with n:1

   15 fundamental associations with 1:N link

   24 fundamental associations with n:N link

5. ***Reconstruction for Russia as a whole between 1991 and 1992***
   107 fundamental associations (Annex 9) were constructed including:
   71 fundamental associations with 1:1 link
   1 fundamental association with n:1 link
   8 fundamental associations with 1:N link
   27 fundamental associations with n:N link

For certain 1:N and n:N associations, the transition coefficients were different by sex and/or age groups in order to take into account age and sex specific patterns. Figure 6 presents an example of age- and sex-specific coefficients within the association for skin neoplasms. In SC-1988 all skin neoplasms were included into the item "Malignant neoplasm of skin". In RC-1999 that item was split into two separate categories "Malignant melanoma of skin" and "Other malignant neoplasm of skin". This is 1:N association and in the first step of estimating the transition coefficients we should simply calculate the proportions the two new items had within the association in 1999. Thus it would be 2223/3668 = 0.60605 for "Malignant melanoma of skin" and 1445/3668=0.39395 for "Other malignant neoplasms of skin". But if we apply the same coefficients to all age/sex-specific groups, we observe disruptions for many of them. In fact at young ages the vast majority of skin neoplasms are malignant melanomas. The share of malignant melanomas among all other skin neoplasm gradually decreases with age and at ages 75 and above, this share appears to be less than 50%. Some differences between the sexes also exist. At age 40-69 the share of melanomas among all neoplasms of skin is slightly higher for males than for females.

Association 45 (Russia excluding 4 regions)

69	Malignant melanoma of skin	2223	3501	56	P	Malignant neoplasm of skin
70	Other malignant neoplasms of skin	1445	"	56	P	
45	**69, 70**	**3668**	**3501**			**56**

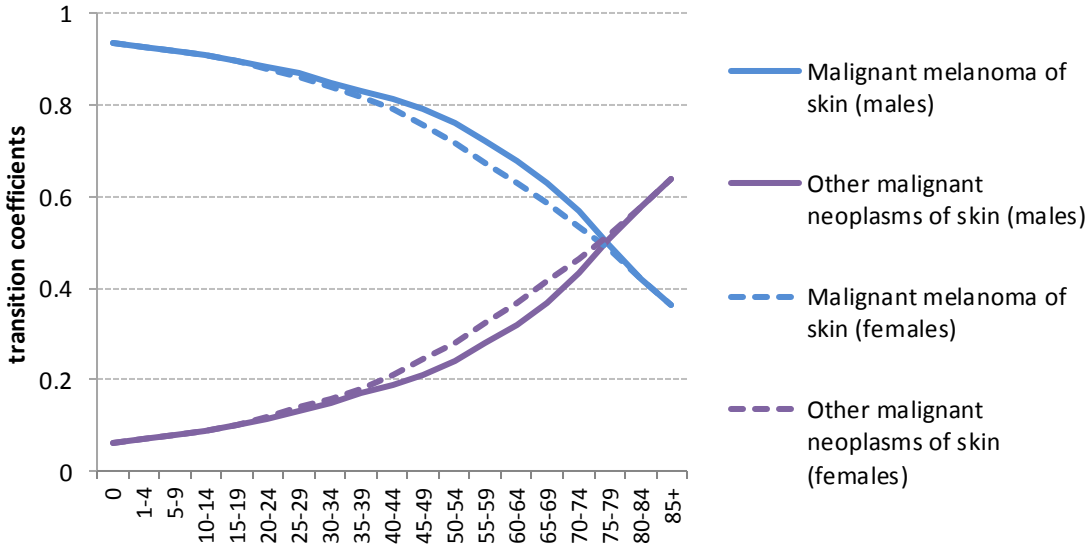


Figure 6. Transition coefficients for recalculating the item "Malignant neoplasm of skin" (SC-1988) into the items "Malignant melanoma of skin" and "Other malignant neoplasms of skin" (RC-2006)

Causes of death not subject to reconstruction

Two causes of death that currently exist in the Russian Abridged Classification -"Operations of war" and "Terrorism" - were not subject to reconstruction. The series for these causes are not available in the HCD before the first year the cause was introduced in Russian Abridged Classification (year 1999 for "Operations of war" and year 2004 for "Terrorism").

A posteriori corrections

A few a posteriori corrections were applied after the reconstruction. At first, the series were corrected for obvious coding mistakes, such as:

- Senility before age 60 (deaths were re-assigned to the category "Other ill-defined and unspecified causes of mortality")
- Perinatal causes of death after 1 year (deaths were re-assigned to the category "Other ill-defined and unspecified causes of mortality")
- Suicides at age before 5 years (deaths were re-assigned to the category "Injury undetermined whether accidentally or purposely inflicted"
- Alzheimer disease before age 20 (deaths were re-assigned to the category "Other diseases of the nervous system")

The series were also corrected for unexpected changes in coding practices that took place at a time point different from the official transitions to new classification.

Redistribution of ill-defined causes of death

In 1989 the Soviet Health Minister, Evgeni Chazov, issued a decree for registering deaths at ages 80+ as "Senility" unless there is an evidence of external cause or there are medical records suggesting a specific diagnosis. At the same time that decree forbade assigning deaths to the acute cardiovascular diseases before age 80 unless an autopsy was performed (Meslé et al. 1996). The implementation of the new coding rules had resulted in a massive transfer of deaths from the chapter "diseases of the circulatory system" to the ICD chapter "symptoms, signs, and ill-defined conditions" (Meslé et al. 1996). The same changes in cause-specific mortality trends were observed in Ukraine (Meslé and Vallin, 2012) and Belarus (Grigoriev, 2012).

During the previous reconstruction performed on Russian data, all ill-defined causes of death were redistributed proportionally among all the other causes (Meslé et al. 1996). But while performing the reconstructions in other post-Soviet countries – Ukraine and Belarus – this approach was re-thought. In Ukraine deaths coded under the item "Senility" after the year 1989 were redistributed among circulatory diseases exclusively (Meslé and Vallin, 2012). In Belarus all deaths from senility were re-assigned to the item "Atherosclerotic cardiosclerosis without hypertensive heart disease" of the Abridged Belarusian Classification. Performing the current reconstruction for Russia, we had decided to apply the approach used in Ukraine and redistribute deaths coded under the item "Senility" after 1989 only among the items constituting the chapter "Diseases of the circulatory system". The deaths coded under the item "Other ill-defined and unspecified causes of mortality" in Russian Abridged Classification

were proportionally re-distributed among all (not ill-defined) causes of death. Before 1989 deaths from both items – "Senility" and "Other ill-defined and unspecified causes of mortality" – were redistributed proportionally among all the other causes. Figure 7 shows how mortality from diseases of the circulatory system and all other causes changes before and after redistribution of ill-defined causes of death.

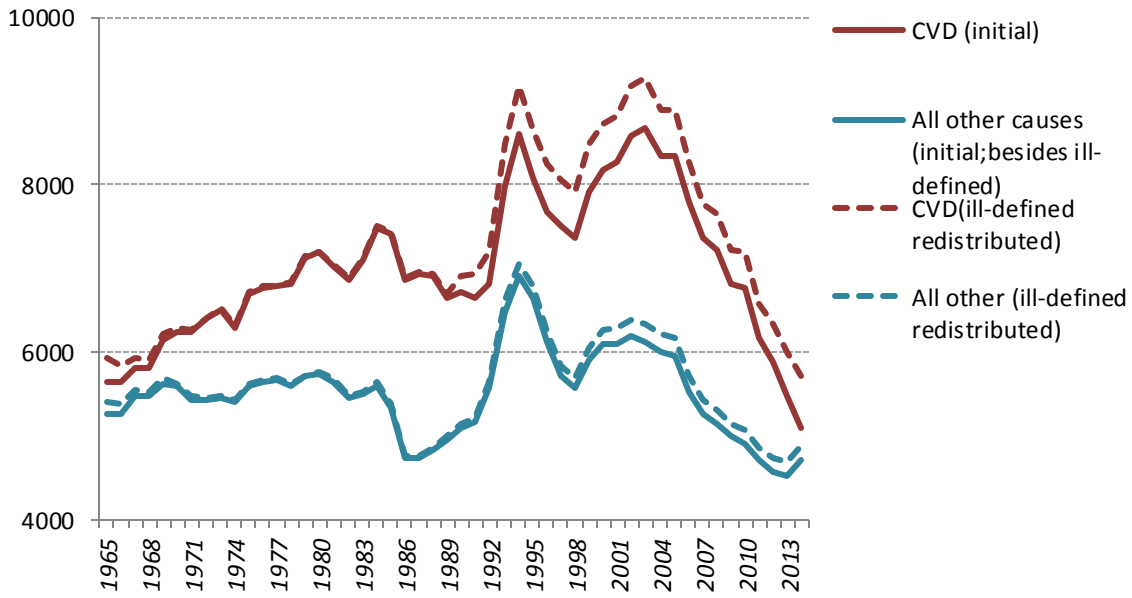


Figure 7. Standardized death rates from circulatory diseases (CVD) and all other causes of death before and after redistribution of ill-defined causes of death, Russia, both sexes, 1965-2014

10. References

Andreev, E. (1995). Infant mortality in Russia. Statistical issues. Vol.5, pp.66-71

Andreev, E., Kvasha, E. (2002). Peculiarity of infant mortality indicators in Russia [in Russian], *Problems of social hygiene, public health services and history of medicine*. Vol.4, pp.15-20.

Andreev, E., Kvasha, E. (2013). New count of infant mortality: preliminary results [in Russian]. Demoscope Weekly. Vol.541-542. Retrieved from: http://www.demoscope.ru/weekly/2013/0541/analit05.php

Gavrilova, N.S., Semyonova, V.G., Dubrovina, E., Evdokushkina, G.N., Ivanova, A.E., Gavrilov, L.A. (2008). Russian Mortality Crisis and the Quality of Vital Statistics. *Popul Res Policy Rev* doi:10.1007/s11113-008-9085-6.

Grigoriev, P., Meslé, F., Vallin, J. (2012). Reconstruction of continuous time series of mortality by cause of death in Belarus, 1965–2010. *MPIDR working paper*, *WP-2012-023*

Kvasha, E. (2014). Mortality of children under one year of age in Russia: what has changed after the transition to the new definition of live birth and stillbirth. *Demographic Review*. Vol. 1(2), pp.38-56

Mathers, C.D., Fat, D.M., Inoue, M., Rao, C., Lopez, A.D. (2005). Counting the dead and what they died from: an assessment of the global status of cause of death data. *Bull World Health Organ*. Vol. 83, pp.171-177

Meslé, F. and Vallin, J. (2012). Reconstructing series of deaths by cause with constant definitions. In *Mortality and Causes of death in* 20th-Century Ukraine. Demographic Research Monographs: a series of the Max Planck Institute for Demographic Research.

Meslé, F., Shkolnikov, V., Hertrich, V., Vallin, J. (1996). Recent trends in mortality by causes of death in Russia during 1965-1994 [In French and Russian], Paris-Moscow.

Meslé, F., Vallin, J., Hertrich, V., Andreev, E., Shkolnikov, V. (2003). Causes of death in Russia: assessing trends since the 1950s In: Irena E. Kotowska and Janina Józwiak (ed.) European Population Conference. Population of Central and Eastern Europe. Challenges and Opportunities. . Warsaw, Statistical Publishing Establishment. pp.389-414

Vaysman, D.Sh.(2015). Improving the data warehousing system for mortality assessment and analysis at the regional level in Russian Federation [in Russian]. (Doctoral thesis, Federal Research Institute for Health Organization and Informatics of Ministry of Health of the Russian Federation). Retrieved from: http://www.mednet.ru/images/stories/files/replay/Vaysman_text.pdf

11. List of acronyms

Goskomstat – Gosudarstvenny komitet statistiki, Central Statistical Office of the USSR

Rosstat – Federalnaya sluzhba gosudarstvennoy statistiki, Federal State Statistics Service

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