Consistency of cause-specific mortality data at subnational level in Russia, France, Germany, and the U.S.

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Background

Cause-of-death (CoD) mortality analysis is (mostly) the **analysis of the underlying cause data**

Selection of the underlying cause depends on:

Quality of diagnostics (pre- and postmortem)

Certification process

Interpretation of the ICD-rules by the coder

Approaches of certifying and selecting some specific causes as underlying **differ across and within countries**

Potential **inconsistencies** in CoD data **should be revealed before performing the analysis**

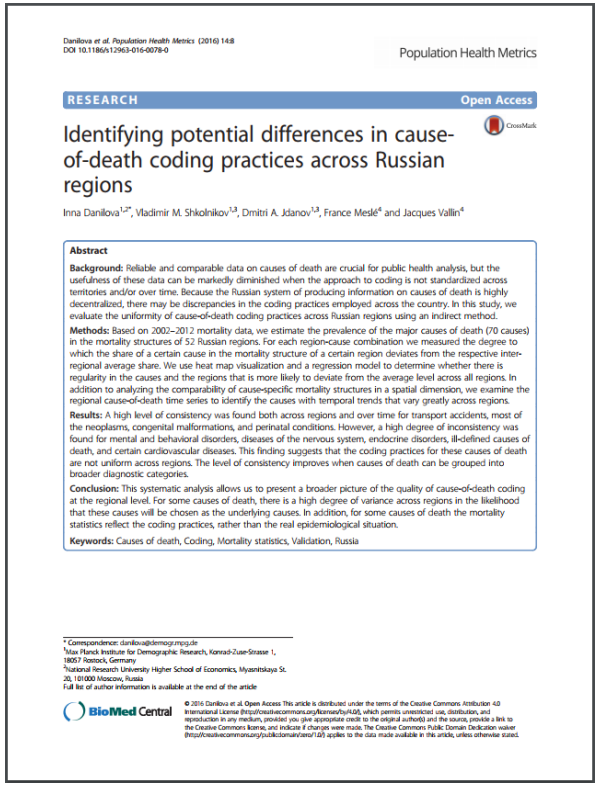
Motivation for the study

An idea to perform cause-specific mortality analysis across Russian regions (as part of a PhD Thesis and other projects)

The question arose: which causes can be analyzed at regional level?

Search for an answer resulted in a **paper published in 2016**. The paper presented **the method of indirect assessment of the consistency of causes of death** at subnational level. The method was illustrated by **applying it to the Russian data**

What about other countries?



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Population Health Metrics

RESEARCH Open Access

Identifying potential differences in cause-of-death coding practices across Russian regions

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Abstract

Background: Reliable and comparable data on causes of death are crucial for public health analysis, but the usefulness of these data can be markedly diminished when the approach to coding is not standardized across territories and/or over time. Because the Russian system of producing information on causes of death is highly decentralized, there may be discrepancies in the coding practices employed across the country. In this study, we evaluate the uniformity of cause-of-death coding practices across Russian regions using an indirect method.

Methods: Based on 2002–2012 mortality data, we estimate the prevalence of the major causes of death (70 causes) in the mortality structures of 52 Russian regions. For each region-cause combination we measured the degree to which the share of a certain cause in the mortality structure of a certain region deviates from the respective inter-regional average share. We use heat map visualization and a regression model to determine whether there is regularity in the causes and the regions that is more likely to deviate from the average level across all regions. In addition to analyzing the comparability of cause-specific mortality structures in a spatial dimension, we examine the regional cause-of-death time series to identify the causes with temporal trends that vary greatly across regions.

Results: A high level of consistency was found both across regions and over time for transport accidents, most of the neoplasms, congenital malformations, and perinatal conditions. However, a high degree of inconsistency was found for mental and behavioral disorders, diseases of the nervous system, endocrine disorders, ill-defined causes of death, and certain cardiovascular diseases. This finding suggests that the coding practices for these causes of death are not uniform across regions. The level of consistency improves when causes of death can be grouped into broader diagnostic categories.

Conclusion: This systematic analysis allows us to present a broader picture of the quality of cause-of-death coding at the regional level. For some causes of death, there is a high degree of variance across regions in the likelihood that these causes will be chosen as the underlying causes. In addition, for some causes of death the mortality statistics reflect the coding practices, rather than the real epidemiological situation.

Keywords: Causes of death, Coding, Mortality statistics, Validation, Russia

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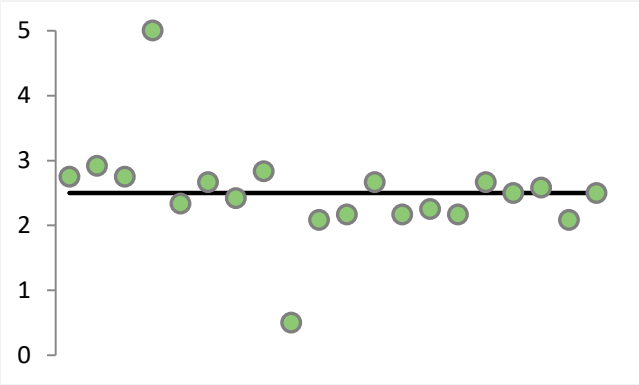
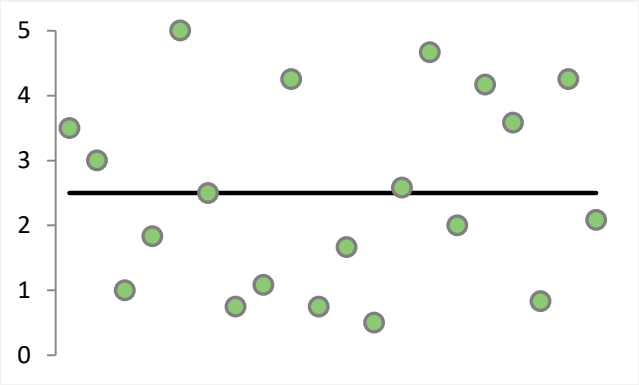
How to identify potential inconsistencies in the cause-specific mortality data when only the data itself are available?

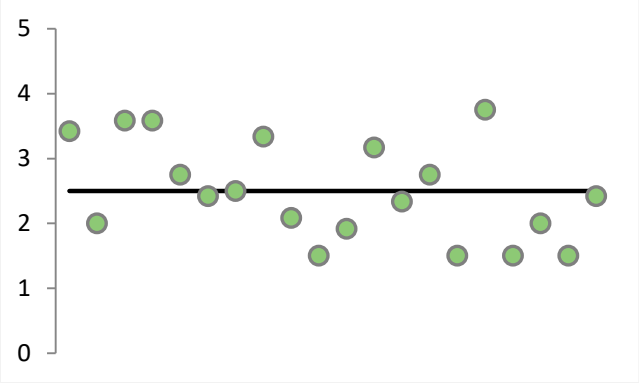
Variability measures



CoefVar = 30%
Max/Min = 10



CoefVar = 57%
Max/Min = 10



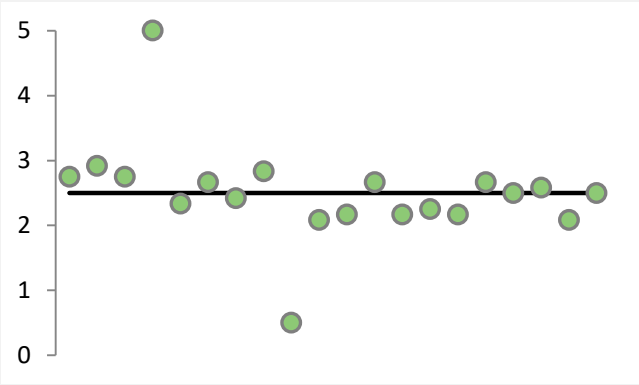
CoefVar = 30%
Max/Min = 2.5

Drawbacks:

Can return the same values for very different distributions

Information behind the values is hidden

Visual inspection



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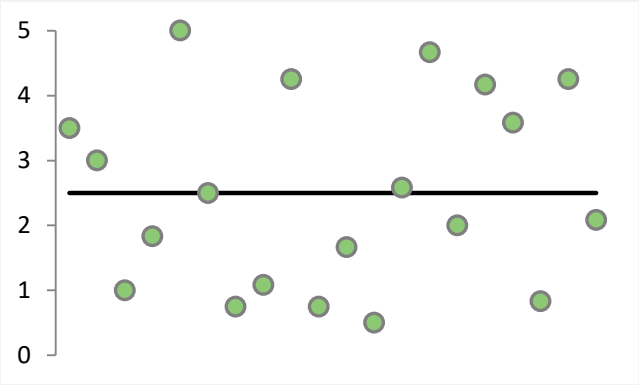

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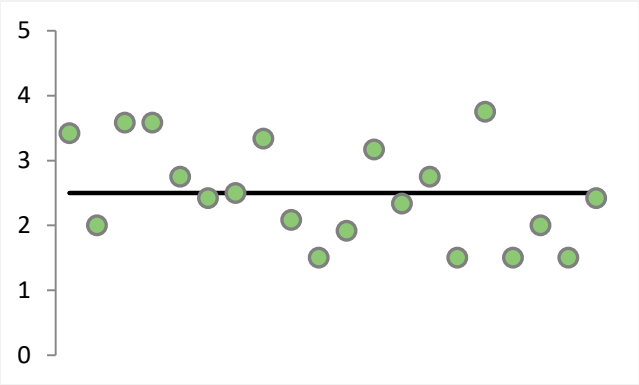


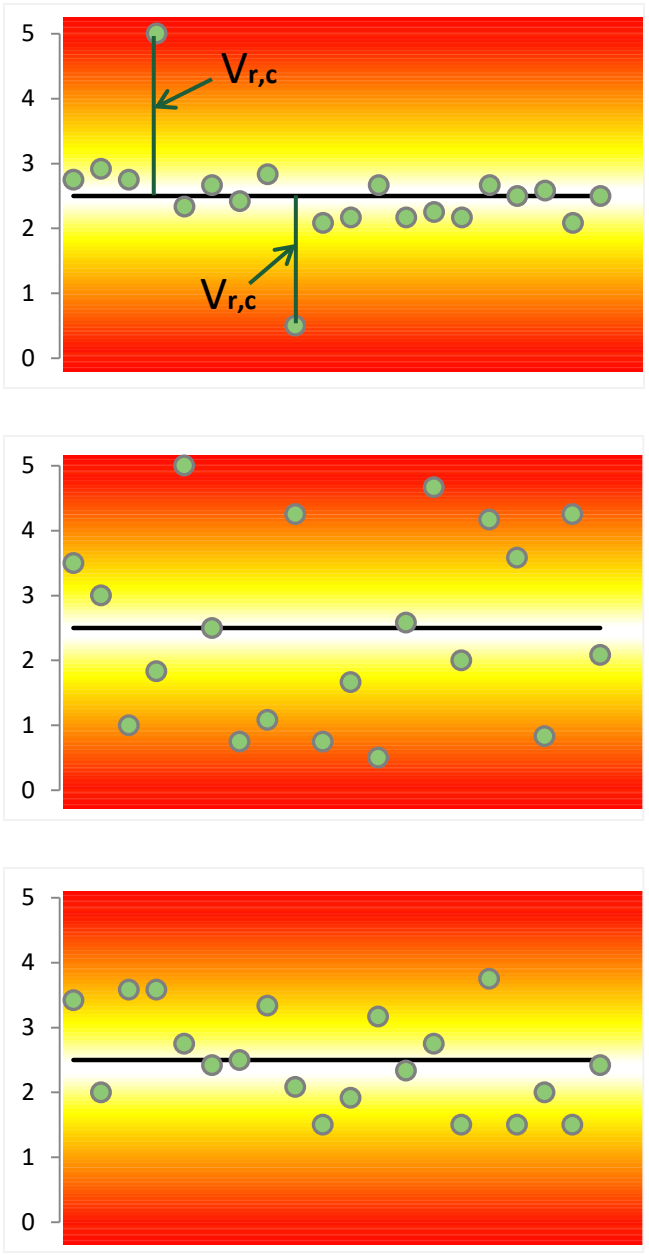
CoefVar = 30%
Max/Min = 2.5

Drawbacks:

Time consuming

Not systematized

Heatmaps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$V_{r,c}$
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subnational entities
causes of death

Application to the real data

4 highly populated countries with different systems of producing information on causes of death

Countries:	Period:	Subnational areas: (with annual population ≥ 1 mln.)
France	**2005-2009**	**20 metropolitan regions**
Germany	**2005-2009**	**15 federal states**
The USA	**2008-2012**	**43 states**
Russia	**2005-2009**	**52 regions**

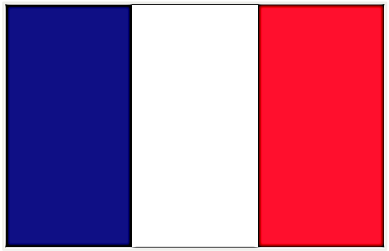
67 groups of CoD (the same for the four countries)

Indicators:

$$S_{r,c} = \frac{SDR_{r,c}}{SDR_r} \cdot 100\% \Rightarrow V_{r,c} = \frac{\left| S_{r,c} - \overline{S_{*,c}} \right|}{\overline{S_{*,c}}} \cdot 100\%$$

Producing information on causes of death

FRANCE



Centralized coding. Death certificates are coded by the French Epidemiological Center for the Medical Causes of Death (CépiDc).

The automated coding system was implemented in 2000.

GERMANY

Coding is **centralized at the level of Federal States** (Länder).

In 2007 the implementation of the automated coding system was initiated **(automated coding was used very rarely before 2012**). Federal States are free to decide if and in which cases the coding software should be applied.

Producing information on causes of death

THE U.S.

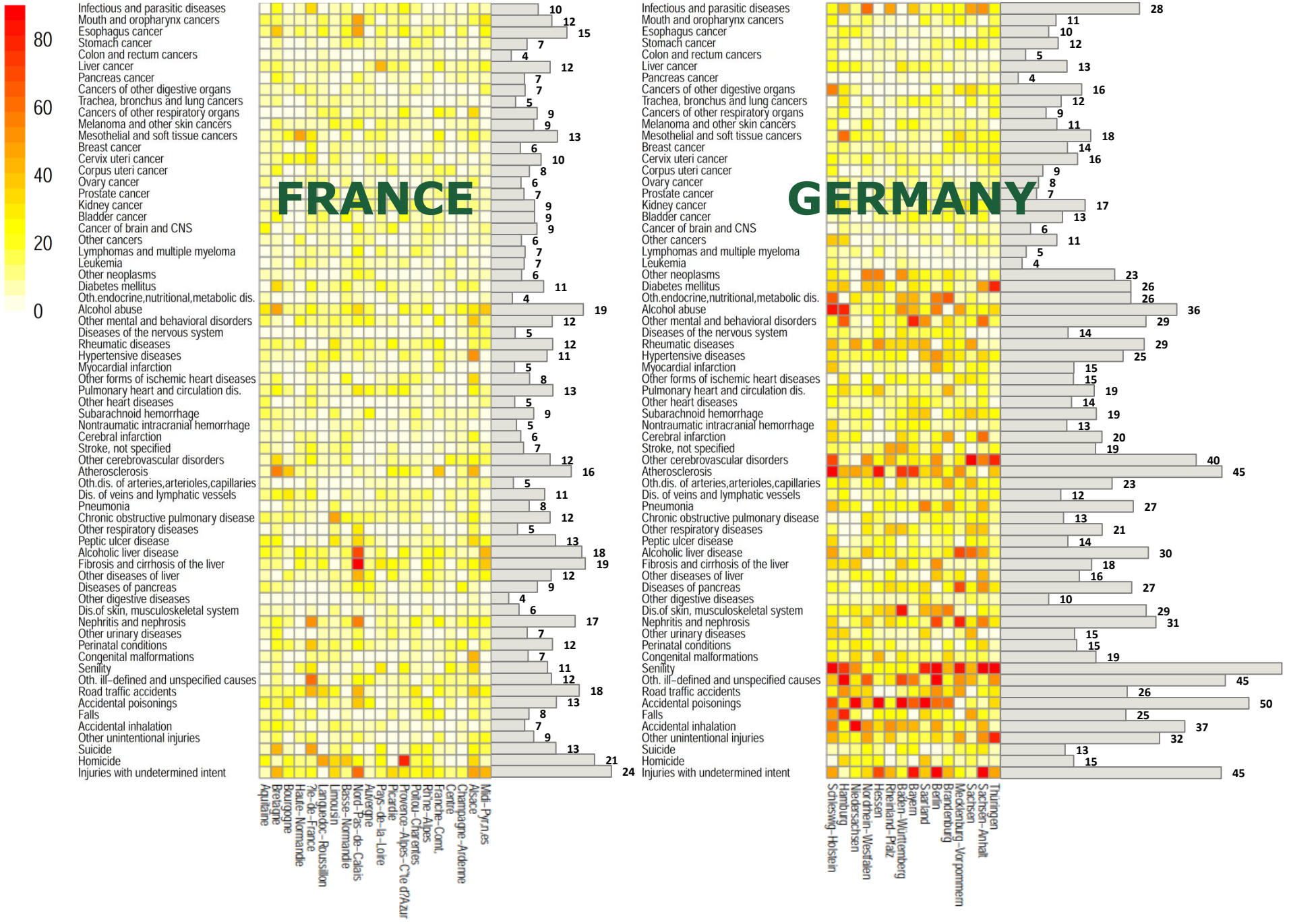
Death certificates are coded by the National Center for Health Statistics (before 2011 some states processed death certificates on their own).

The automated coding system is used since 1968 and had been developed further since then several times.

RUSSIA

Coding is **decentralized.** Medical practitioners who certify the death are at the same time responsible for choosing the UCD and coding it in accordance with ICD rules.

Automated coding systems are in use in some regions. The automatization of the coding process **is not centralized** at the federal level.


80
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FRANCE
GERMANY
Infectious and parasitic diseases
Mouth and oropharynx cancers
Esophagus cancer
Stomach cancer
Colon and rectum cancers
Liver cancer
Pancreas cancer
Cancers of other digestive organs
Trachea, bronchus and lung cancers
Cancers of other respiratory organs
Melanoma and other skin cancers
Mesothelial and soft tissue cancers
Breast cancer
Cervix uteri cancer
Corpus uteri cancer
Ovary cancer
Prostate cancer
Kidney cancer
Bladder cancer
Cancer of brain and CNS
Other cancers
Lymphomas and multiple myeloma
Leukemia
Other neoplasms
Diabetes mellitus
Oth.endocrine,nutritional,metabolic dis.
Alcohol abuse
Other mental and behavioral disorders
Diseases of the nervous system
Rheumatic diseases
Hypertensive diseases
Myocardial infarction
Other forms of ischemic heart diseases
Pulmonary heart and circulation dis.
Other heart diseases
Subarachnoid hemorrhage
Nontraumatic intracranial hemorrhage
Cerebral infarction
Stroke, not specified
Other cerebrovascular disorders
Atherosclerosis
Oth.dis. of arteries,arterioles,capillaries
Dis. of veins and lymphatic vessels
Pneumonia
Chronic obstructive pulmonary disease
Other respiratory diseases
Peptic ulcer disease
Alcoholic liver disease
Fibrosis and cirrhosis of the liver
Other diseases of liver
Diseases of pancreas
Other digestive diseases
Dis.of skin, musculoskeletal system
Nephritis and nephrosis
Other urinary diseases
Perinatal conditions
Congenital malformations
Senility
Oth. ill-defined and unspecified causes
Road traffic accidents
Accidental poisonings
Falls
Accidental inhalation
Other unintentional injuries
Suicide
Homicide
Injuries with undetermined intent
10 12 15 7 4 12 7 7 5 9 9 13 6 10 8 6 7 9 9 9 6 7 7 6 11 4 19 12 5 12 11 5 8 13 5 9 5 6 7 12 16 5 11 8 12 5 13 18 19 12 9 4 6 17 7 12 7 11 12 18 13 8 7 9 13 21 24
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Aquitaine
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Languedoc-Roussillon
Limousin
Basse-Normandie
Nord-Pas-de-Calais
Auvergne
Pays-de-la-Loire
Picardie
Provence-Alpes-Côte d'Azur
Poitou-Charentes
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Alsace
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Schleswig-Holstein
Hamburg
Niedersachsen
Nordrhein-Westfalen
Hessen
Rheinland-Pfalz
Baden-Württemberg
Bayern
Saarland
Berlin
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Mecklenburg-Vorpommern
Sachsen
Sachsen-Anhalt
Thüringen


THE USA
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Infectious and parasitic diseases 18
Mouth and oropharynx cancers 10
Esophagus cancer 13
Stomach cancer 18
Colon and rectum cancers 5
Liver cancer 15
Pancreas cancer 10
Cancers of other digestive organs 16
Trachea, bronchus and lung cancers 9
Cancers of other respiratory organs 13
Melanoma and other skin cancers 12
Mesothelial and soft tissue cancers 17
Breast cancer 7
Cervix uteri cancer 14
Corpus uteri cancer 17
Ovary cancer 11
Prostate cancer 9
Kidney cancer 8
Bladder cancer 14
Cancer of brain and CNS 13
Other cancers 9
Lymphomas and multiple myeloma 9
Leukemia 8
Other neoplasms 14
Diabetes mellitus 10
Oth.endocrine,nutritional,metabolic dis. 11
Alcohol abuse 35
Other mental and behavioral disorders 17
Diseases of the nervous system 12
Rheumatic diseases 26
Hypertensive diseases 25
Myocardial infarction 21
Other forms of ischemic heart diseases 18
Pulmonary heart and circulation dis. 16
Other heart diseases 18
Subarachnoid hemorrhage 10
Nontraumatic intracranial hemorrhage 9
Cerebral infarction 17
Stroke, not specified 10
Other cerebrovascular disorders 17
Atherosclerosis 37
Oth.dis. of arteries,arterioles,capillaries 9
Dis. of veins and lymphatic vessels 16
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Chronic obstructive pulmonary disease 13
Other respiratory diseases 10
Peptic ulcer disease 20
Alcoholic liver disease 37
Fibrosis and cirrhosis of the liver 17
Other diseases of liver 17
Diseases of pancreas 9
Other digestive diseases 8
Dis.of skin, musculoskeletal system 13
Nephritis and nephrosis 13
Other urinary diseases 17
Perinatal conditions 16
Congenital malformations 10
Senility 89
Oth. ill-defined and unspecified causes 39
Road traffic accidents 21
Accidental poisonings 25
Falls 27
Accidental inhalation 14
Other unintentional injuries 15
Suicide 19
Homicide 33
Injuries with undetermined intent 55
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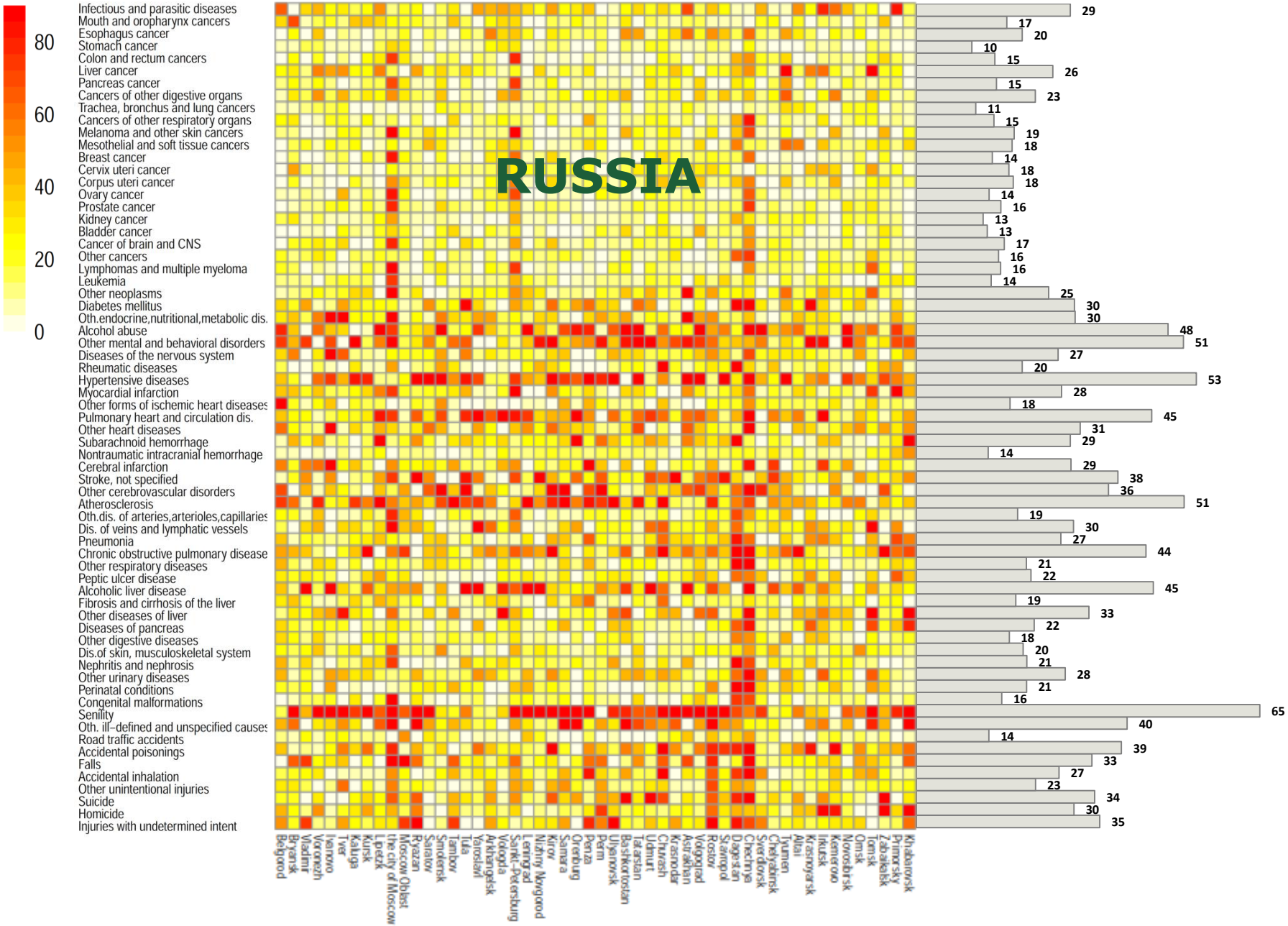
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Tver
Kaluga
Kursk
Lipetzk
the city of Moscow
Moscow Oblast
Ryazan
Saratov
Smolensk
Tambow
Tula
Yaroslavl
Arkhangelsk
Vologda
Sankt-Petersburg
Leningrad
Nizhniy Novgorod
Kirov
Samara
Orenburg
Penza
Perm
Ulyanovsk
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Chuvash
Krasnodar
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Rostov
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Sverdlovsk
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Tyumen
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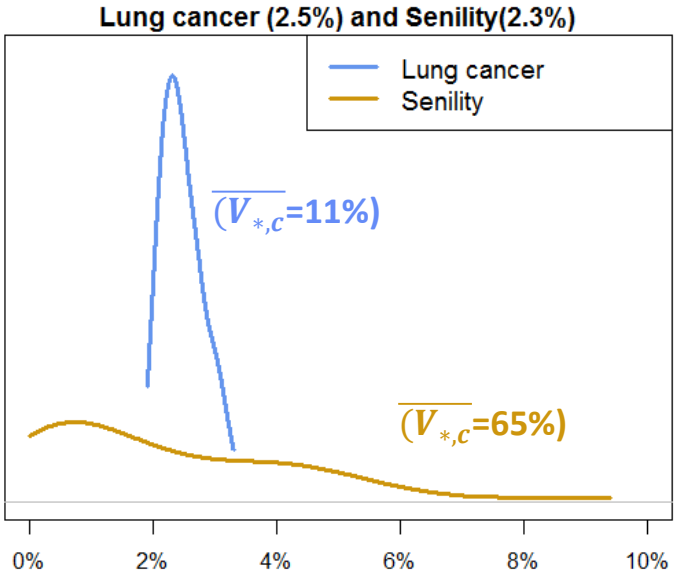
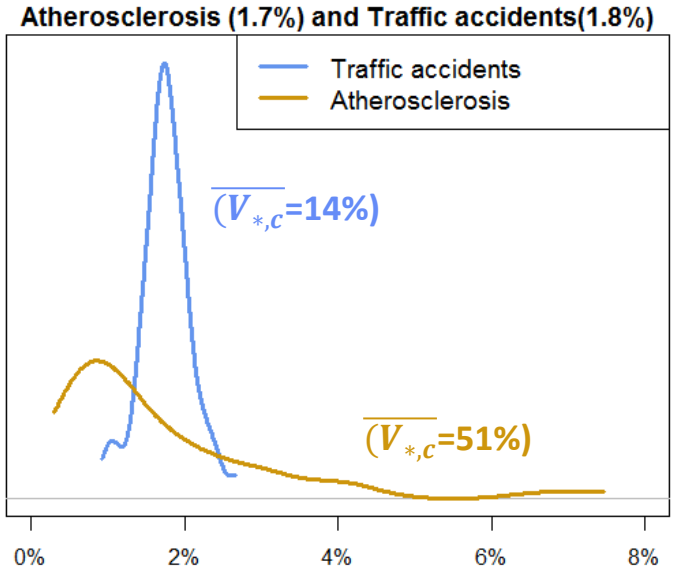
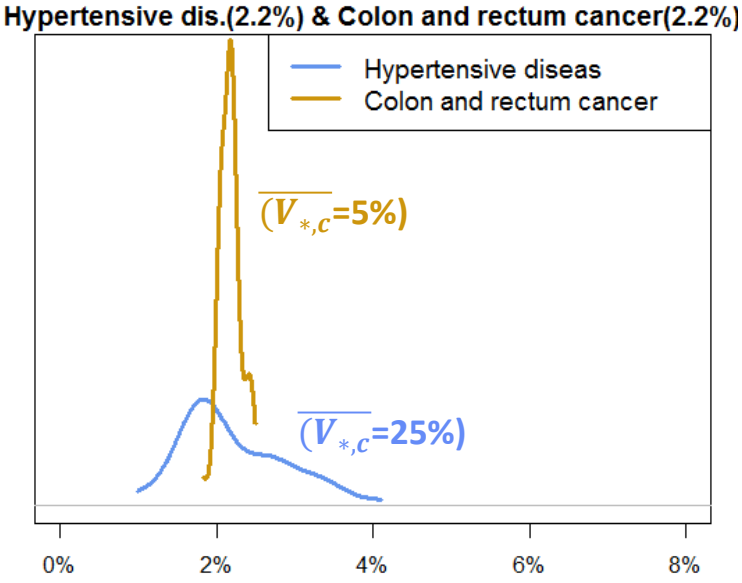
Zabaikalsk
Primorsky
Khabarovsk

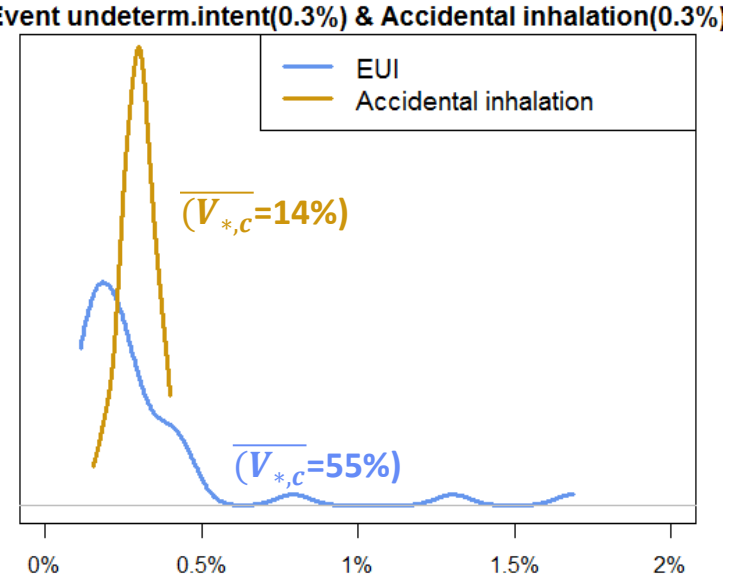
RUSSIA





THE U.S.





Limitations

Indirect method. We reveal POTENTIAL inconsistencies

It is possible that some deviations (even the large ones) are true and caused by real differences in epidemiological patterns

At the same time, smaller deviations (which are not marked as suspicious on the heatmaps) can also be caused, to some extent, by differences in certifying and coding practices

On the heatmaps we do not distinguish between the "size" of the causes of death

The analysis was performed at the top level of countries' subdivision. Different approaches to certifying and coding may exist within regions (states, lands) as well

Conclusion (1)

Heatmaps allow indirect assessment of the consistency of CoD statistics at subnational level presenting the broad picture at one glance

Causes that are easy to be defined as underlying (neoplasms, perinatal causes, congenital malformations, a few other specific diseases) showed low variability in all countries.

“Garbage” and alcohol-related causes tend to have higher variability across subnational units in Germany, the U.S., and Russia indicating that medical professionals may have different views on whether these causes should be reported in the death certificate and/or chosen as underlying

Conclusion (2)

Among the four countries chosen for the analysis, France has the most consistent and comparable cause-of-death mortality data across its subnational entities

Russia has the highest number of CoDs with suspiciously high variability indicating dissimilarity of certifying and coding practices at subnational level

The vertical patterns on the Russian heatmap reveal a few regions which have the most peculiar CoD mortality structures. No vertical patterns are noticeable on the heatmaps for the other countries

Thank you for your attention!

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