International Conference
“Demographic Development of Russia in the Global Context:
Convergence or Divergence?”

# Distribution of deaths from CVD across four-digit codes of the ICD-10 in Russia and the USA

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The Standardized Death Rates (SDR) at ages 20 and older from Cardiovascular Deseases (CVD) per 100 000

| | Men | | Women | |
|---|---|---|---|---|
| | SDR | Difference with Russia | SDR | Difference with Russia |
| Russia (2000-2014) | 2117 | | 1385 | |
| U.K. (2001-2013) | 641 | 1476 | 435 | 950 |
| the USA (2000-2014) | 627 | 1490 | 434 | 951 |
| France (2000-2013) | 440 | 1678 | 323 | 1062 |

European Standard Population 2013. Revision of the European Standard Population - Report of Eurostat's task force - 2013 edition

Our goal is to analyze the differences in terms of 4th character codes of ICD-10 (so to say elementary causes of death).
Total number of non-zero items is 385. The SDRs for majority of items are very small Only for 108 items for men and for 96 items for women SDR is more 1 per 100000 at least at one country.

# We compared distributions of death across 4th character codes using Kendall's rank correlation

Only items with SDR more 1 at least at one countriy are used

**Men *N*=108**

| | Russia | UK | USA | France |
|---|---|---|---|---|
| Russia | 1 | **0.11** | **0.13** | **0.09** |
| UK | **0.11** | 1 | 0.71 | 0.43 |
| USA | **0.13** | 0.71 | 1 | 0.50 |
| France | **0.09** | 0.43 | 0.50 | 1 |

**Women *N*=96**

| | Russia | UK | USA | France |
|---|---|---|---|---|
| Russia | 1 | **0.08** | **0.09** | **0.05** |
| UK | **0.08** | 1 | 0.69 | 0.39 |
| USA | **0.09** | 0.69 | 1 | 0.45 |
| France | **0.05** | 0.39 | 0.45 | 1 |

The distributions of death across 4th character codes for United Kingdom. the USA. and France from the point of view of the ranks of units have some similarities. The distribution for Russia llooks quite different.

"Black" coefficients are significant at the 0.001 level (2-tailed).
"Blue" coefficient is significant at the 0.05 level
"Red" coefficients are not significant at the 0.05 level.

It is difficult to compare simultaneously data for four countries; We will focus on the comparison of Russia and the USA:

- Available data for the USA cover the longest period.
- Large population ensures the stability of death rates.
- Competition with the USA is the long Russian tradition.

# Causes of death. which occupy the first 10 places by their contribution to the difference in SDR between Russia and the USA

| Cause of death<br>Causes are ranked by contribution for men | | Contribution to the general difference | | The rank in the range for women |
|---|---|---|---|---|
| | | Men | Women | |
| **Atherosclerotic heart disease** | I25.1 | 344 | 255 | 1 |
| **Cerebral atherosclerosis** | I67.2 | 172 | 153 | 2 |
| **Stroke. not specified as haemorrhage or infarction** | I64 | 132 | 96 | 3 |
| **Chronic ischaemic heart disease. unspecified** | I25.9 | 129 | 77 | 4 |
| **Other forms of acute ischaemic heart disease** | I24.8 | 96 | 34 | 8 |
| **Old myocardial infarction** | I25.2 | 89 | 32 | 9 |
| **Other forms of chronic ischaemic heart disease** | I25.8 | 78 | 42 | 6 |
| **Cerebral infarction. unspecified** | I63.9 | 53 | 38 | 7 |
| **Generalized and unspecified atherosclerosis** | I70.9 | 49 | 44 | 5 |
| **Cerebral infarction due to unspecified occlusion or stenosis ofcerebral arteries** | I63.5 | 41 | 30 | 10 |
| **Sum of 10 causes** | | 1198 | 812 | |
| **out of total differences** | | 1490 | 951 | |

# Causes of death. which occupy the first 10 places by their contribution to the difference in SDR between Russia and the USA

| Cause of death<br>Causes are ranked by contribution for men | | Contribution to the general difference in percent | | The rank in the range for women |
|---|---|---|---|---|
| | | Men | Women | |
| Atherosclerotic heart disease | I25.1 | 23.1 | 26.8 | 1 |
| Cerebral atherosclerosis | I67.2 | 11.5 | 16.1 | 2 |
| Stroke. not specified as haemorrhage or infarction | I64 | 8.8 | 10.1 | 3 |
| Chronic ischaemic heart disease. unspecified | I25.9 | 8.7 | 8.1 | 4 |
| Other forms of acute ischaemic heart disease | I24.8 | 6.4 | 3.6 | 8 |
| Old myocardial infarction | I25.2 | 6.0 | 3.3 | 9 |
| Other forms of chronic ischaemic heart disease | I25.8 | 5.2 | 4.4 | 6 |
| Cerebral infarction. unspecified | I63.9 | 3.6 | 4.0 | 7 |
| Generalized and unspecified atherosclerosis | I70.9 | 3.3 | 4.7 | 5 |
| Cerebral infarction due to unspecified occlusion or stenosis ofcerebral arteries | I63.5 | 2.8 | 3.2 | 10 |
| Total for 10 causes | | 79.4 | 84.3 | |

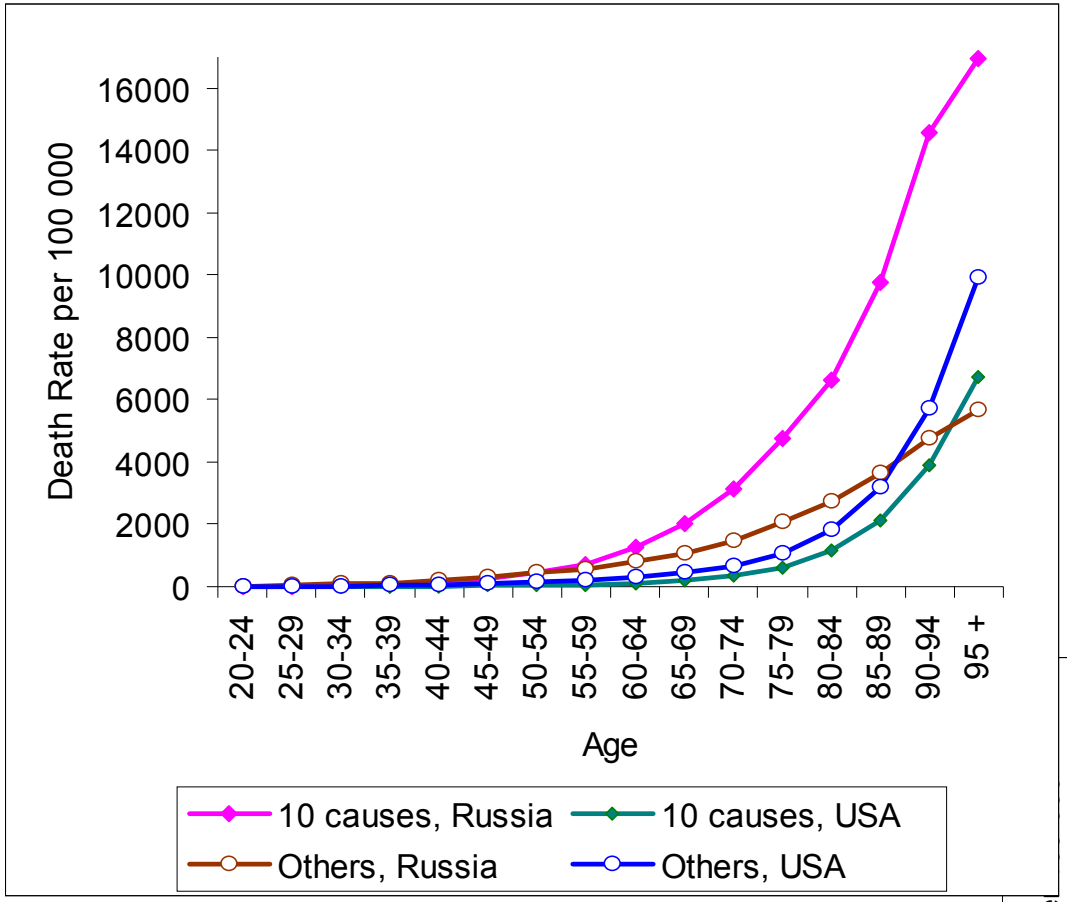
The descriptions of 7 out of these 10 causes contain words "unspecified". "other". or "not specified" and 3 descriptions contain a reference to atherosclerosis.

The contribution of these 10 causes to the differences in SDR from CVD between Russia and France. UK. and the USA; in percent of total differences

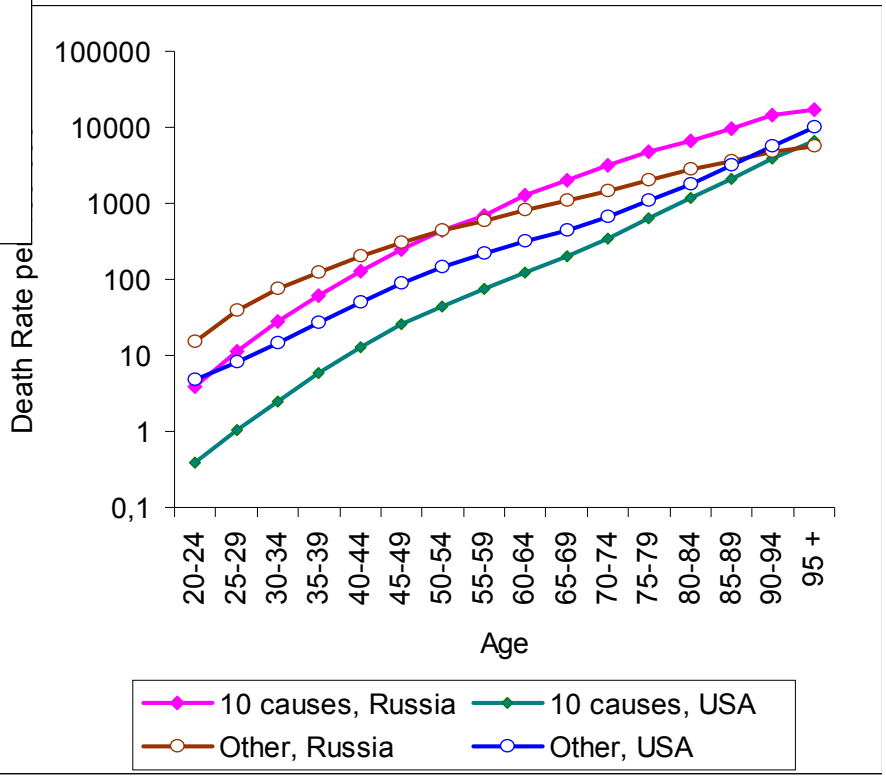
| | UK | USA | France |
|---|---|---|---|
| Men | 76 | 79 | 77 |
| Women | 81 | 84 | 83 |

The proportion of the 10 causes of death in SDR from CVD, percent

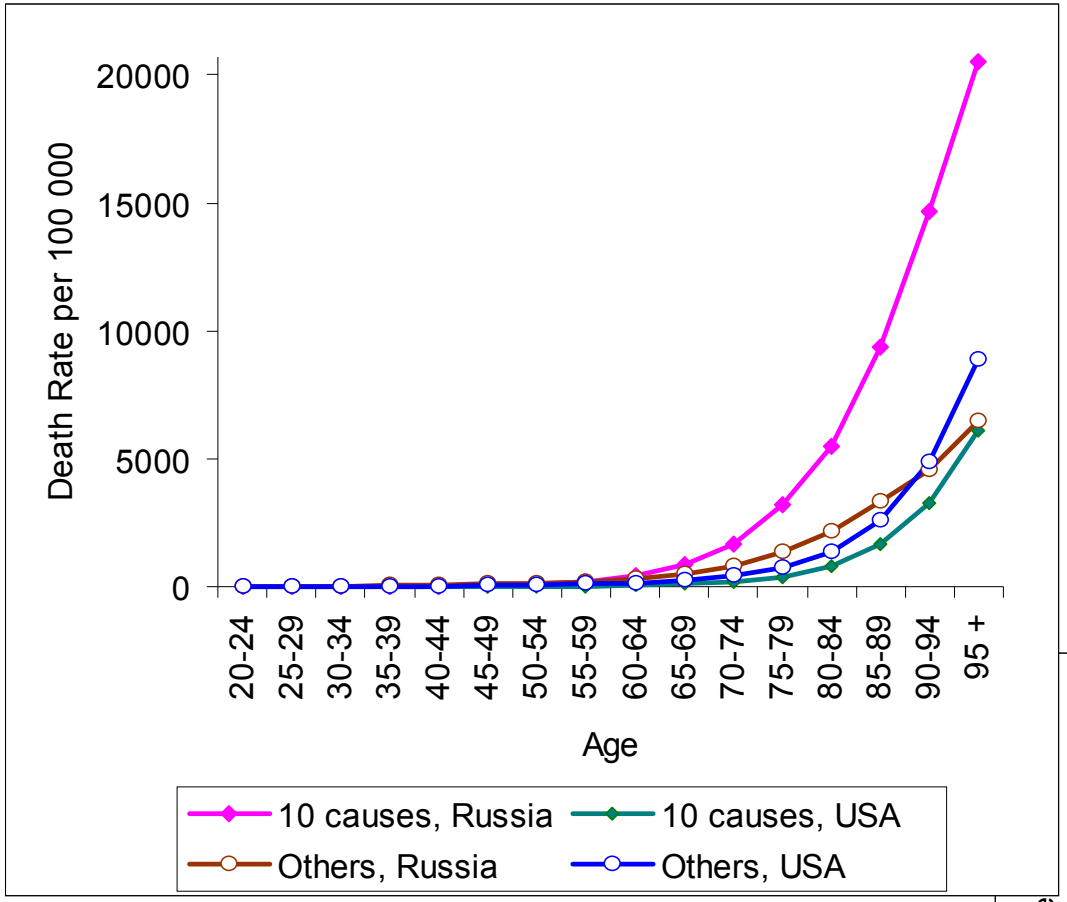
| | Russia | UK | USA | France |
|---|---|---|---|---|
| Men | 67 | 44 | 36 | 25 |
| Women | 69 | 42 | 36 | 24 |




**Age patterns of mortality from the 10 causes and the other causes in Russia and the USA for <u>men</u>.** Death Rate per 100 000. Below there is the same graph in a semilog format

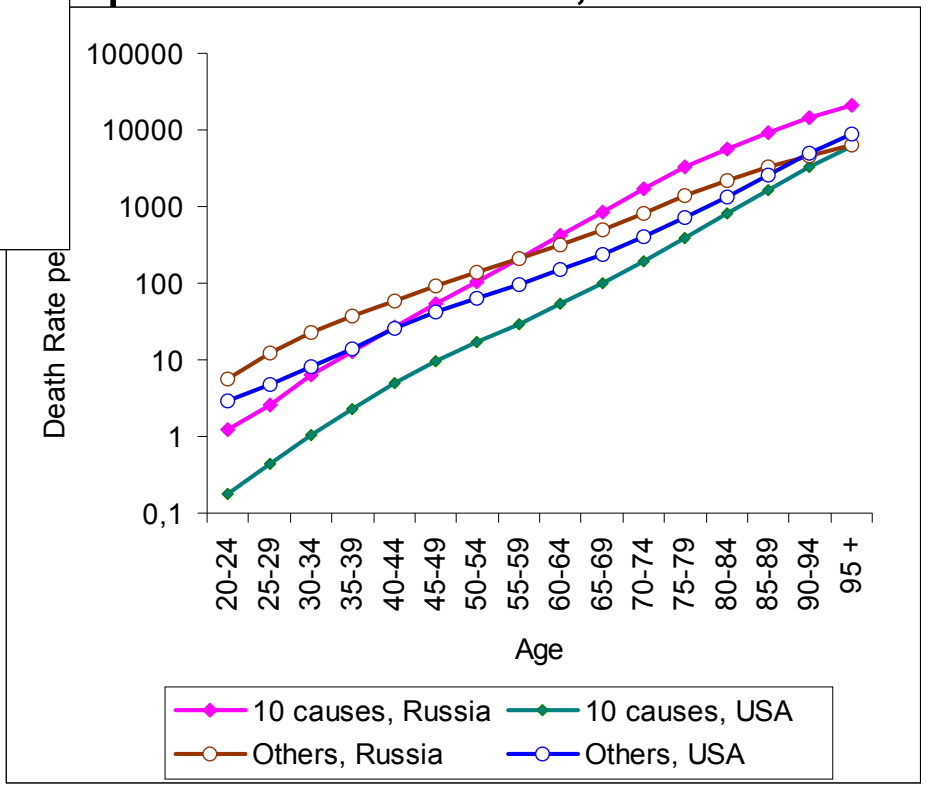



Death rates from the group Others in the USA are higher than from the group10 causes in all ages. In Russia. it's only up to age 55. Further the group Others becomes lower than the US level and the group 10 causes grows very rapidly.




**Age patterns of mortality from the 10 causes and the other causes in Russia and the USA for <u>women</u>.** The picture for women looks the same as for men, only the cross-point is not in 55, but in 60

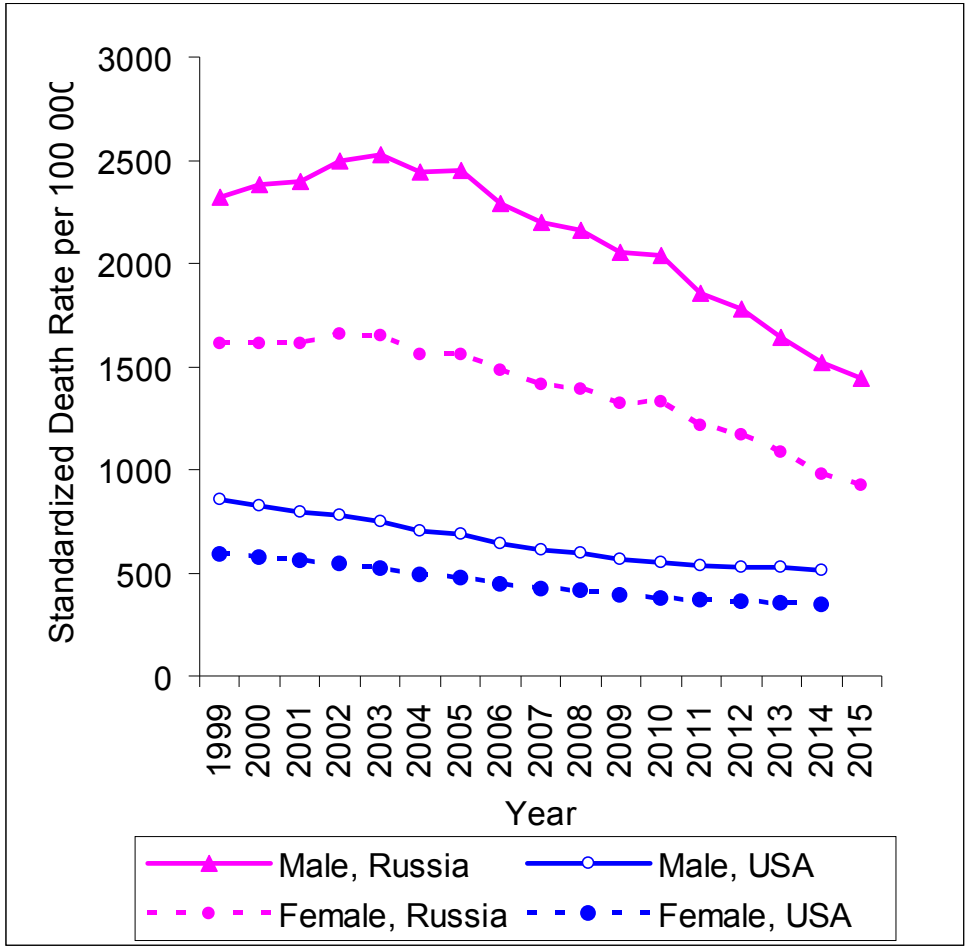
We can't explain why in the USA death rates for 10 causes and Other grow with age with the same speed and in Russia these speeds are so differ. Is it possible that a probability of choosing a diagnosis from the list of 10 causes increases with age in Russia?



# Dynamics of SDR aged 20+ in Russia and the USA in 1999-2015

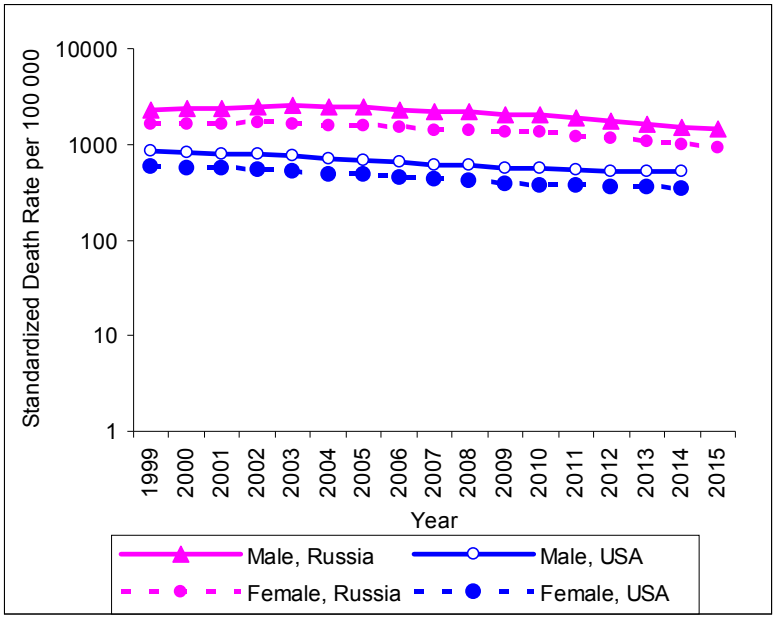
European Standard Population 2013 is used.

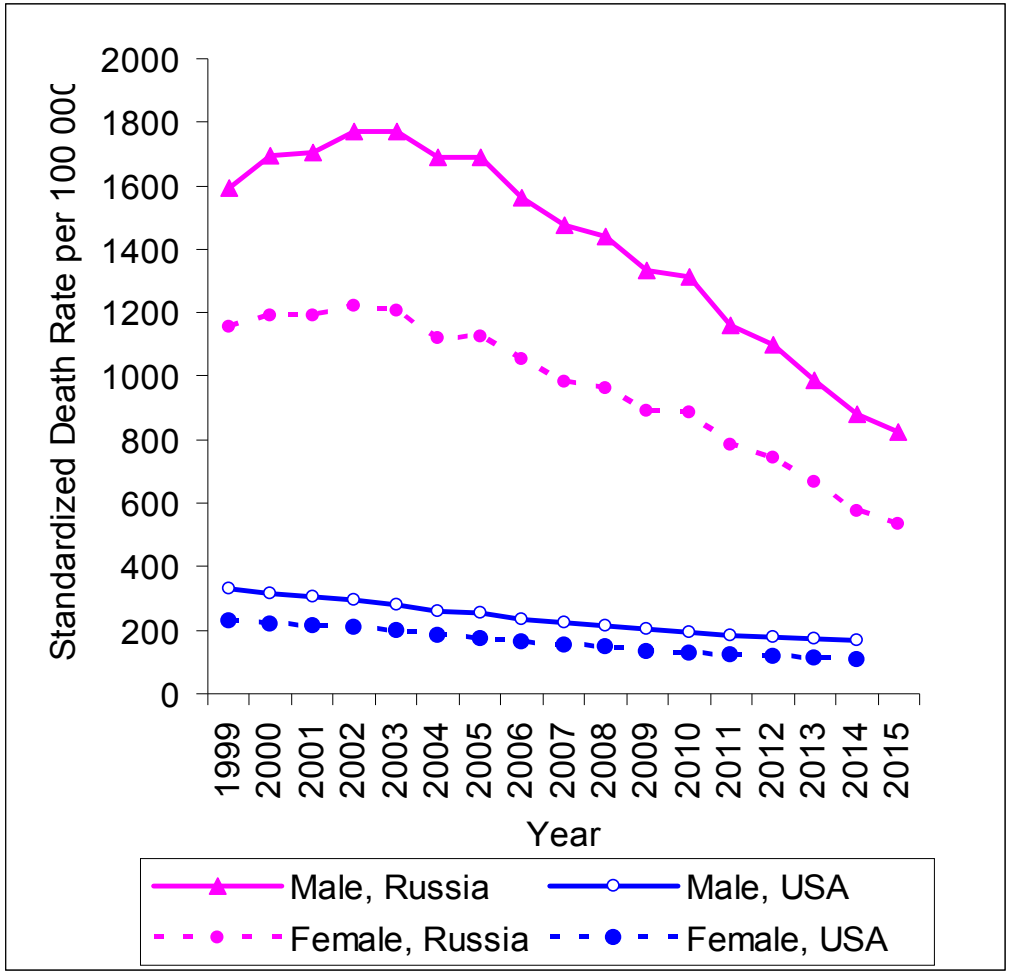
Each slide contains a normal graph and a graph in a semilog format below




# Cardiovascular diseases in general

In Russia compared to the maximum (2003), the SDR for men decreased by 1083 points or 43%, and for women - by 728 points or 44%. During 12 years decline in the USA was 34% and 37% for men and women correspondingly

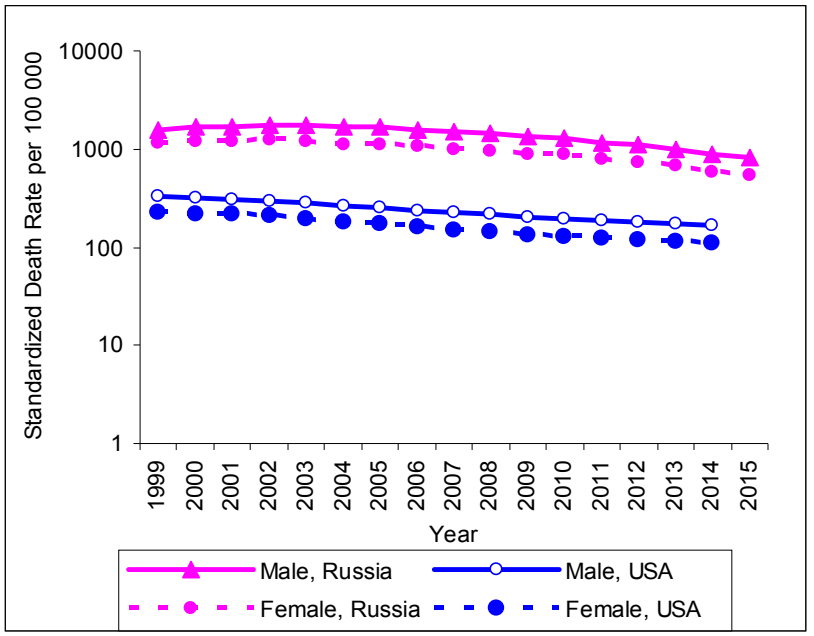


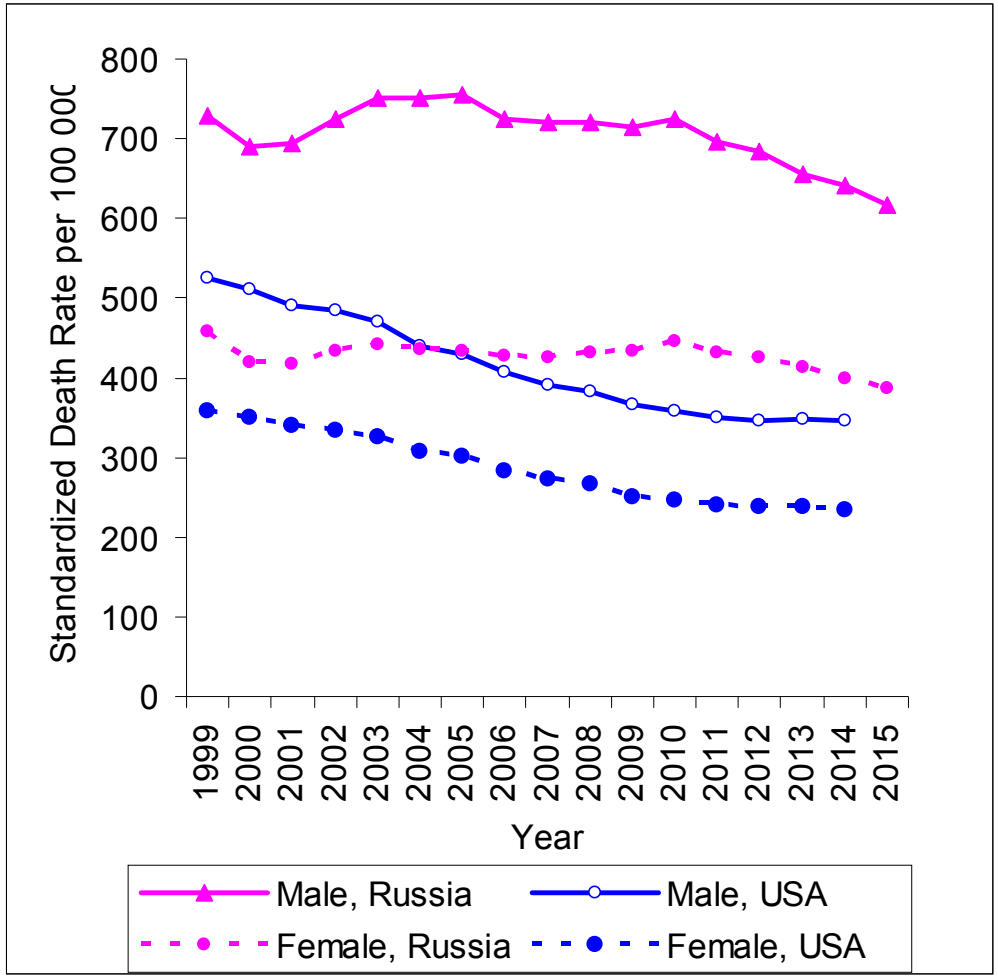



The SDR from 10 causes in Russia decreased more than twice and in the USA by about 45%

## 10 causes

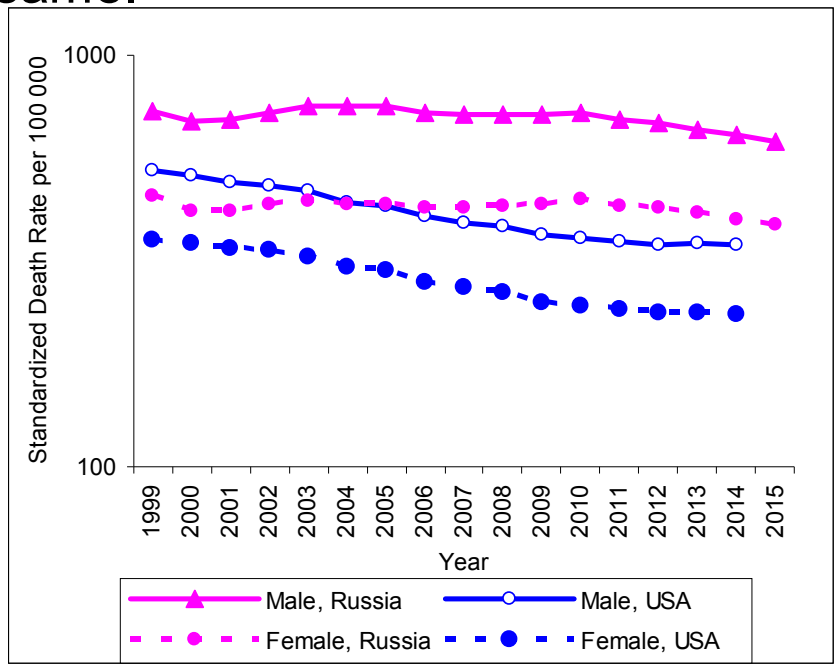
The main part of decline in SDR from CVD in Russia was associated with the group of 10 causes which explained 88% of total decrease for men and 92% for women. In the USA this group explained about half of the decline



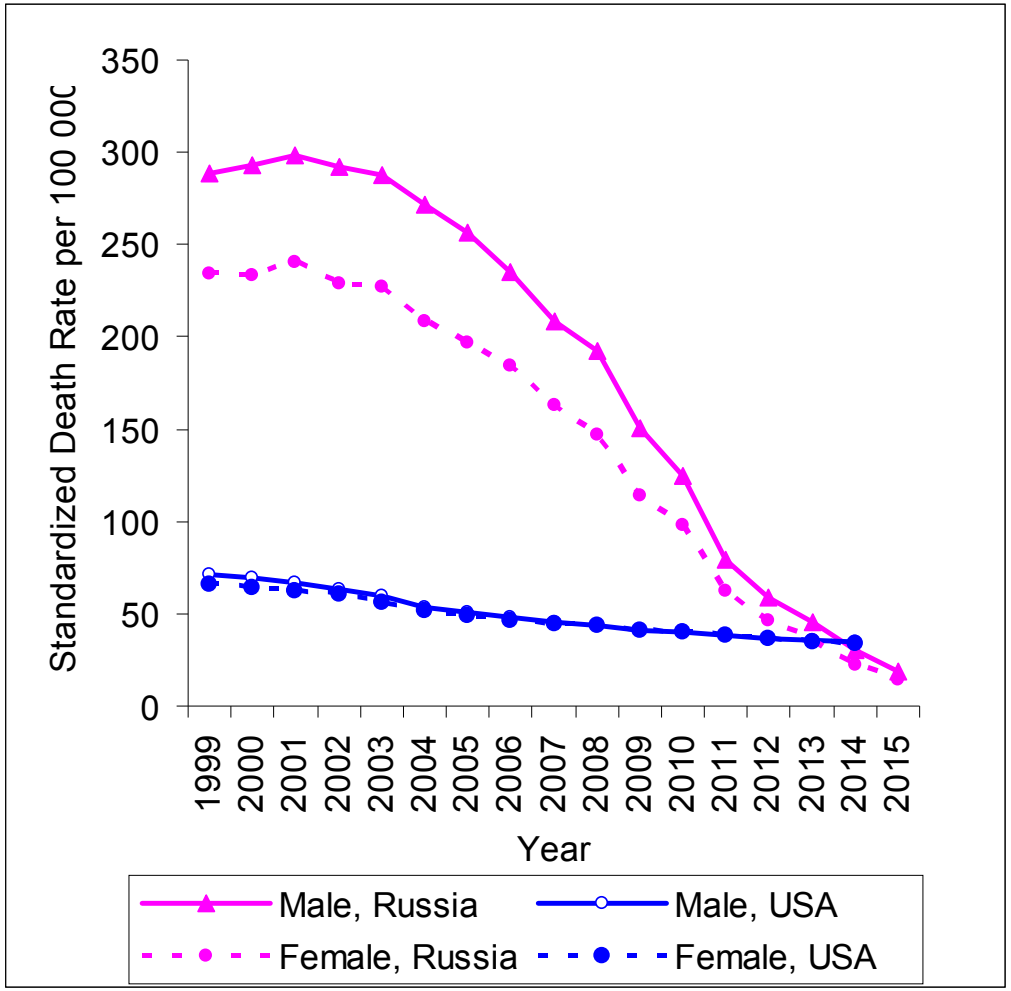



# Other causes

During 12 years the SDR for the group Others decreased in Russia enough slowly: by 18% for men and 13% for women. In the USA, the relative speeds of decline were much less different between groups, and the contribution of groups to decline in SDR from CVD were approximately the same.



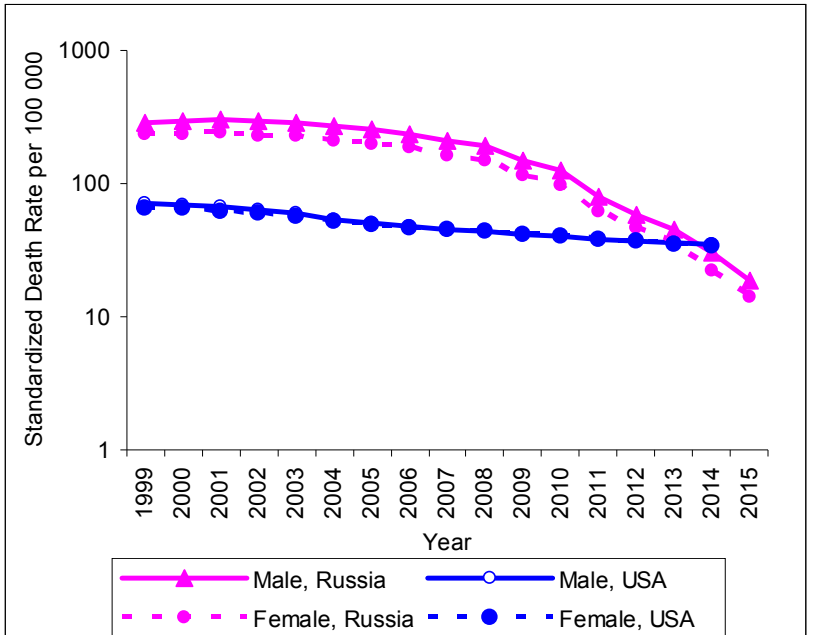

As a result, the SDR for men in the USA fell lower than for women in Russia

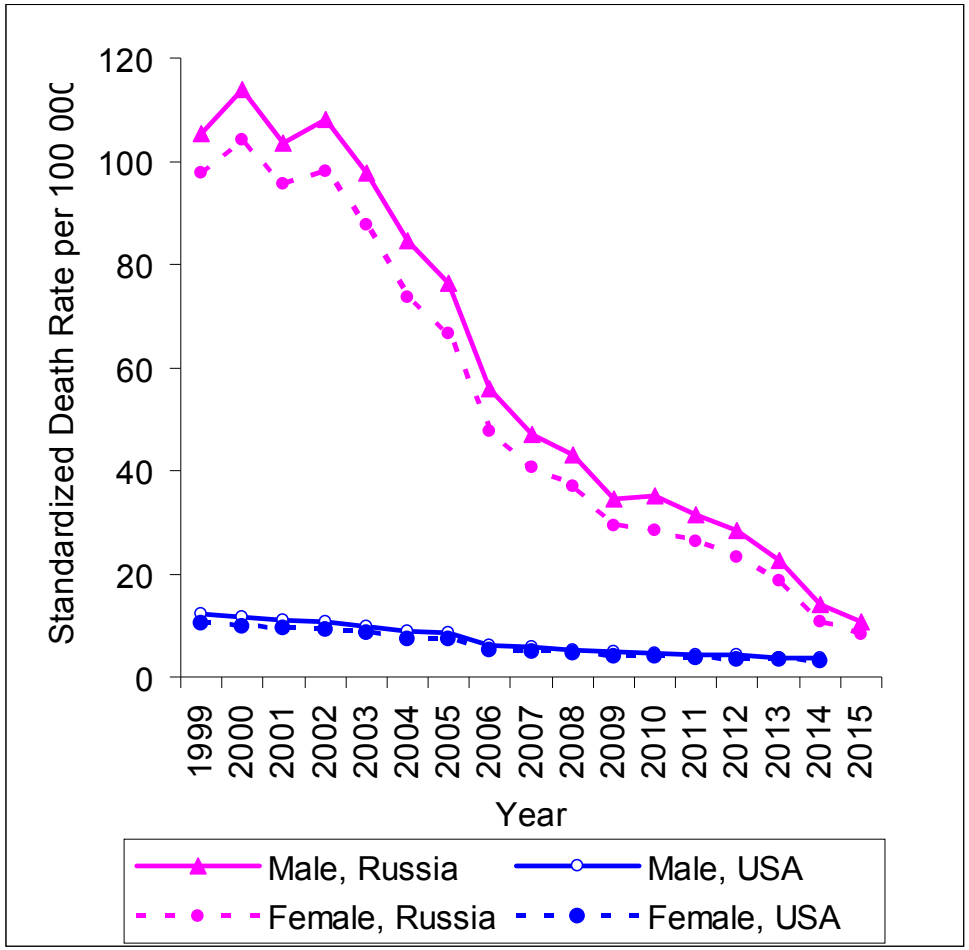



Four causes of death from the list of 10 causes with the fastest decline in the SDR

**1. Stroke, not specified as haemorrhage or infarction (I64)**

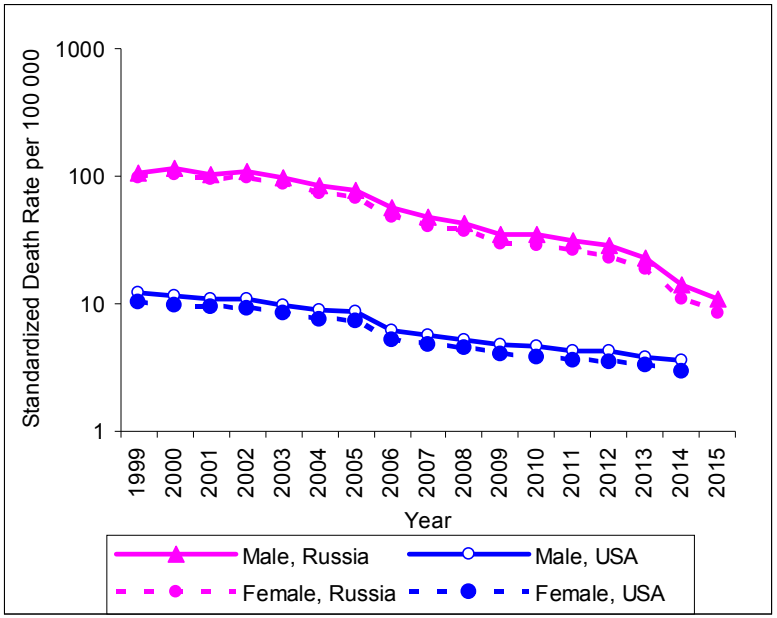
During 12 years SDR for men declined by **93%** and for wom en by **94%**

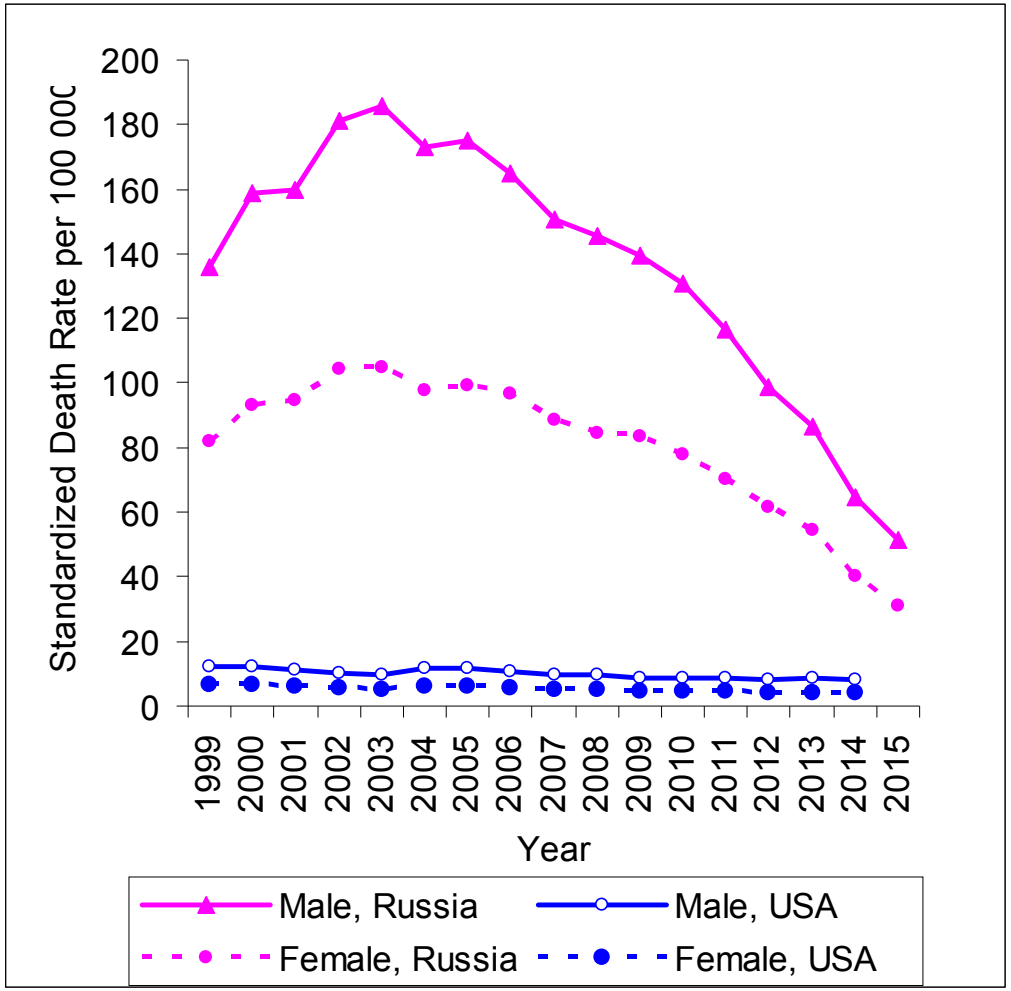





## 2. Generalized and unspecified atherosclerosis (I63.9)

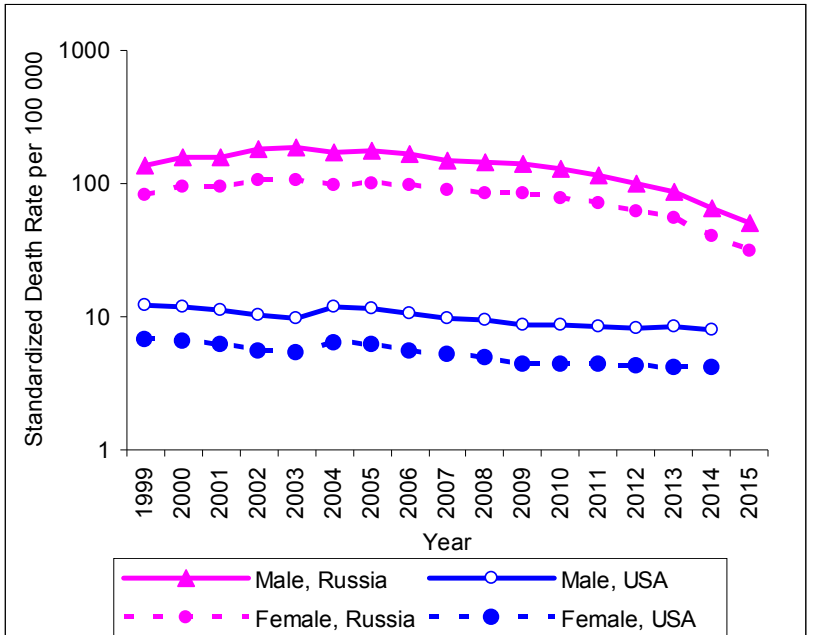
During 12 years SDR for men declined by 89% and for women by **90%**

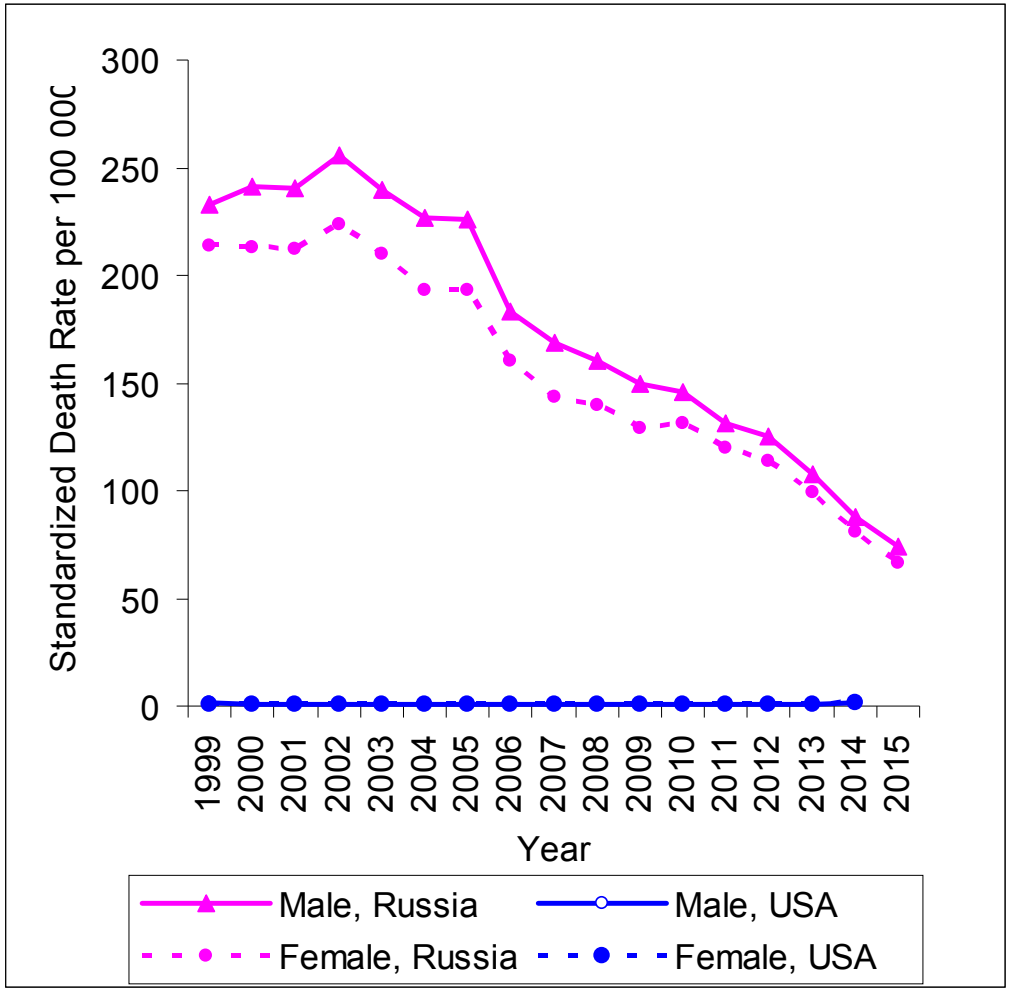





## 3. Chronic ischaemic heart disease, unspecified (I25.9)

During 12 years SDR for mendeclined by **72%** and for women by **70%**

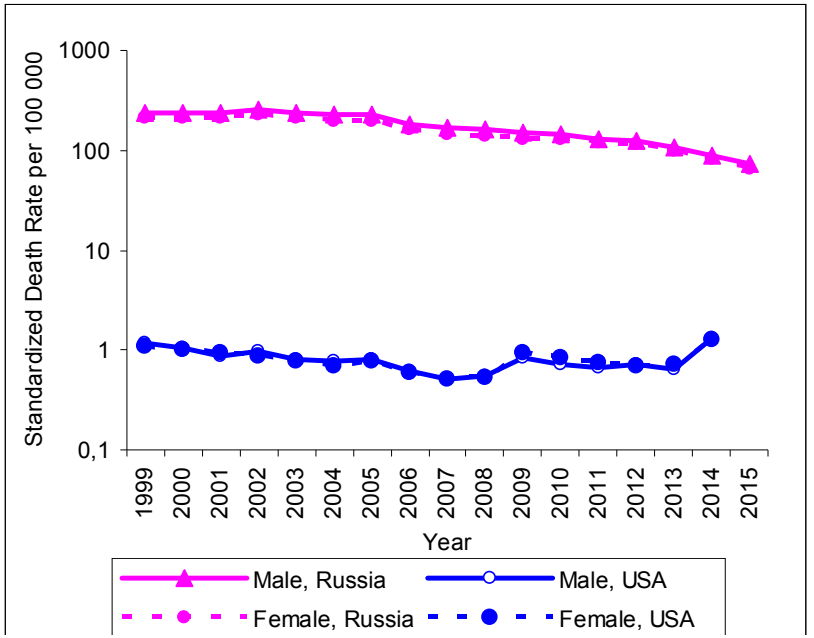


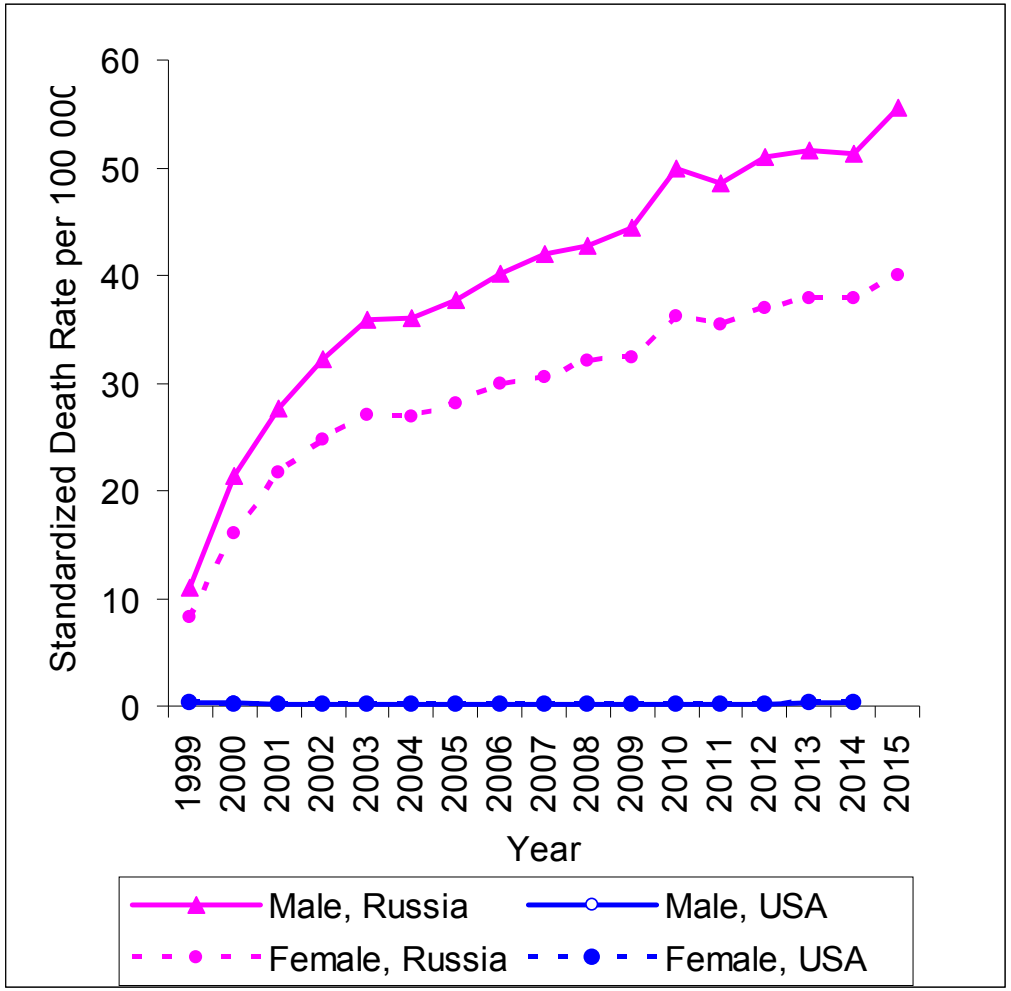



## 4. Cerebral atherosclerosis (I67.2)

During 12 years SDR for men declined by **69%**
and for women by **68%**

Could the fast decline be a consequence of a change in diagnostic practice?

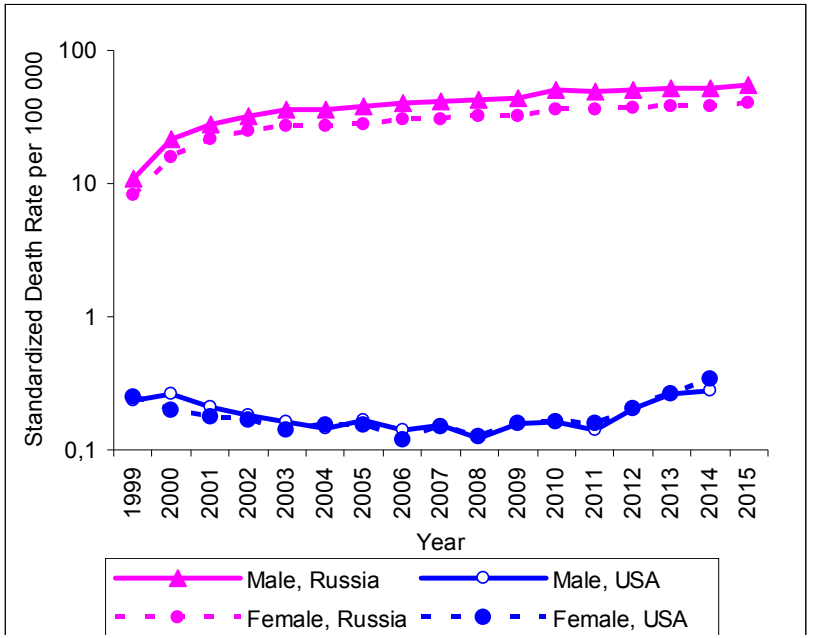


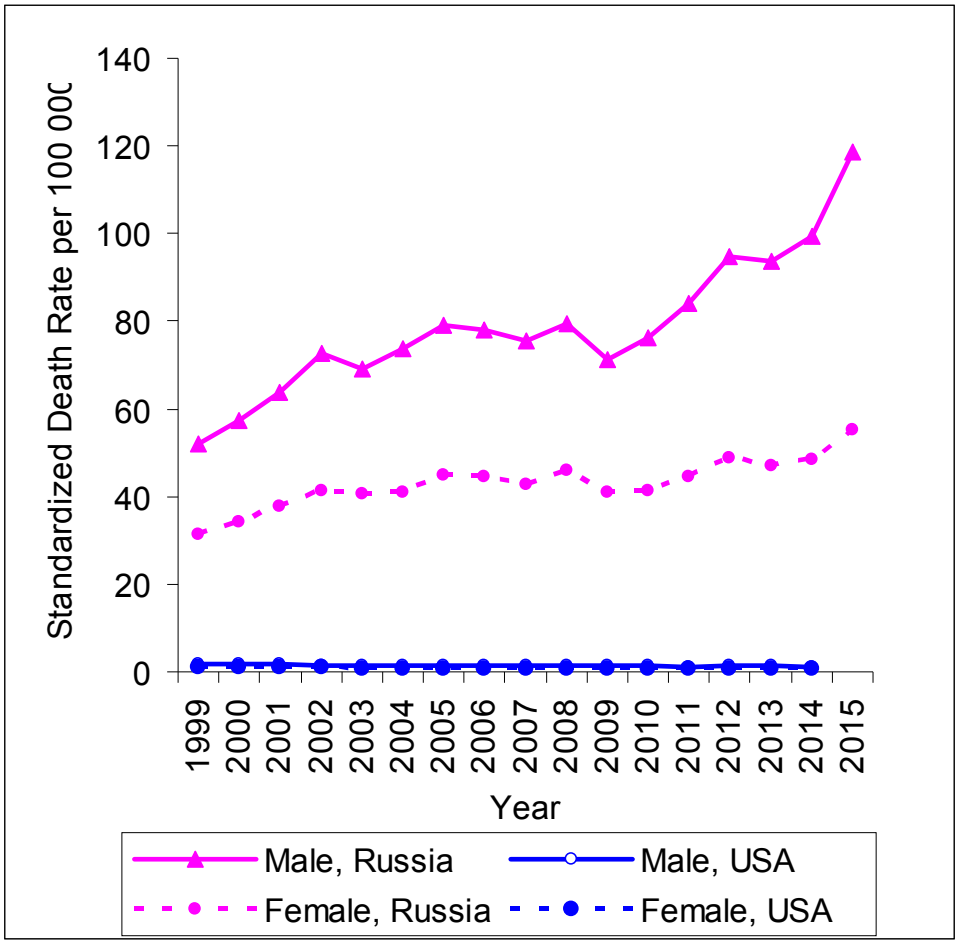



The SDR from next two causes from the list of 10 causes grew

**Cerebral infarction due to unspecified occlusion or stenosis of cerebral arteries (I63.5)**

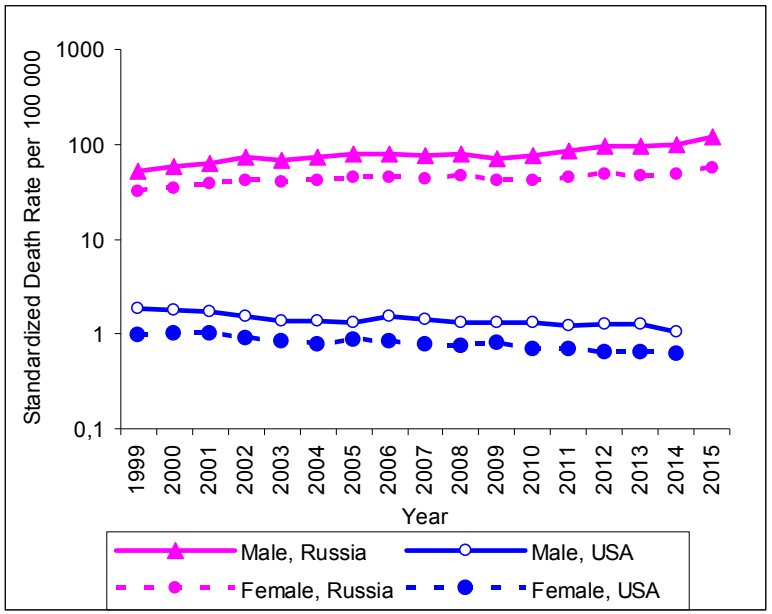
During 12 years SDR for men increased by **55%** and for women by **48%**






## Other forms of chronic ischaemic heart disease (I24.8)

During 12 years SDR for men increased by **72%** and for women by 3**7%**



# Myocardial infarction (MI)

SDR per 100 000

*Acute myocardial infarction, unspecified* (I21.9) is the unique 4-characters ICD-10 item among Diseases of the circulatory system with the SDR in Russia less than in France, UK, and the USA. Due to this circumstance mortality from acute MI in Russia is lower than in three countries. Unexpectedly, the mortality from subsequent MI (also acute but occurring within 28 days from onset of previous MI) is implausibly high. As a result, the overall level is comparable to the three countries.

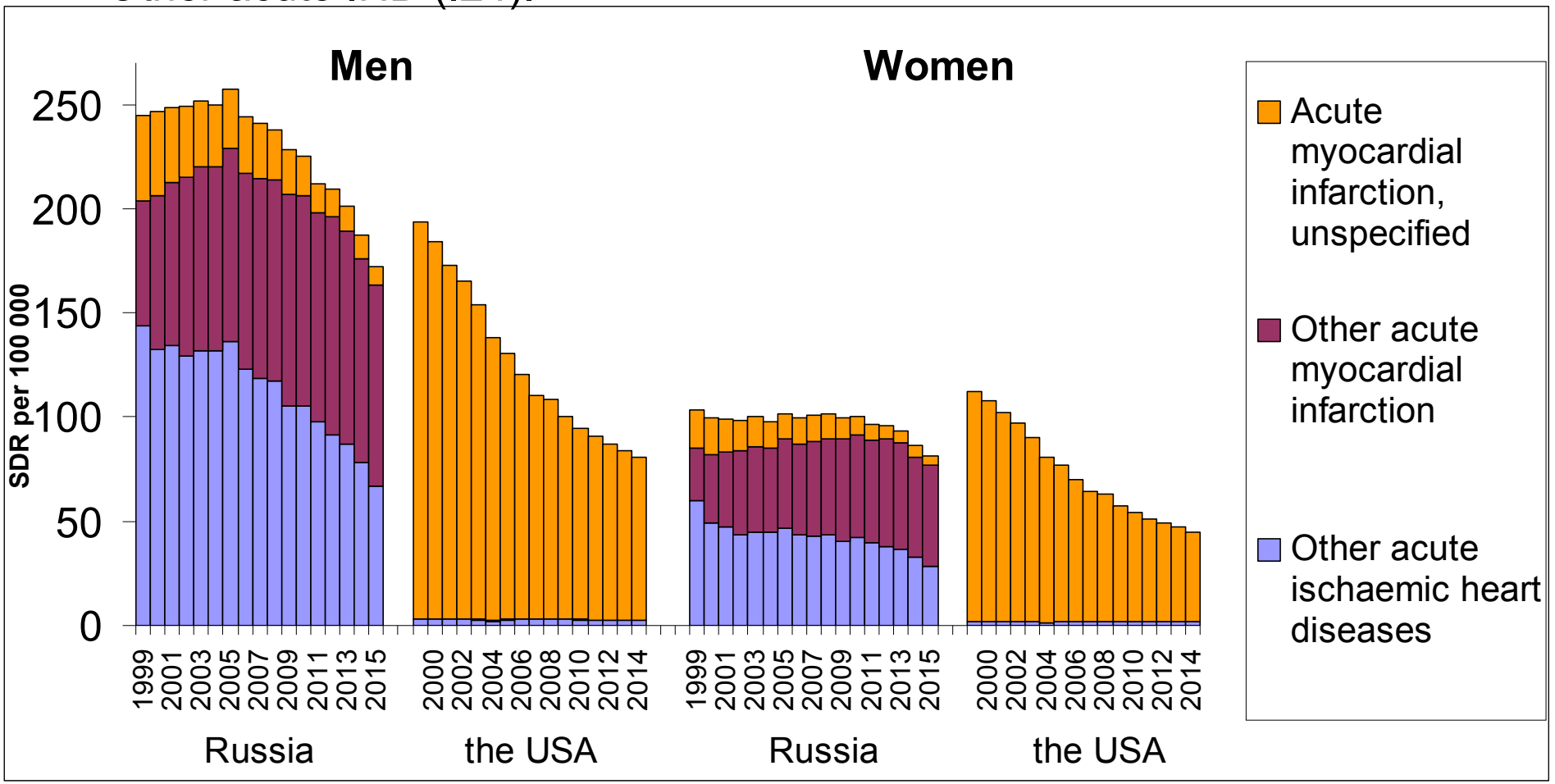
| | Russia | UK | USA | France |
|---|---|---|---|---|
| Men | 24 | 144 | 114 | 63 |
| Women | 11 | 76 | 67 | 32 |

| | | Russia | UK | USA | France |
|---|---|---|---|---|---|
| Men | | | | | |
| Acute MI | I21 | 79 | 145 | 114 | 70 |
| Subsequent MI | I22 | 39 | 0 | 0 | 0 |
| Acute and subsequent MI | I21,I22 | 118 | 145 | 114 | 70 |
| Women | | | | | |
| Acute MI | I21 | 43 | 76 | 67 | 36 |
| Subsequent MI | I22 | 14 | 0 | 0 | 0 |
| Acute and subsequent MI | I21,I22 | 56 | 76 | 67 | 36 |

# Acute ischaemic heart disease (acute IHD) (I21-I24)

Three parts:

- Acute myocardial infarction, unspecified (I21.9).
- Other acute myocardial infarction (I21- I 23 except I21.9).
- Other acute IHD (I24).




Decline in mortality from acute IHD is observed in both countries.

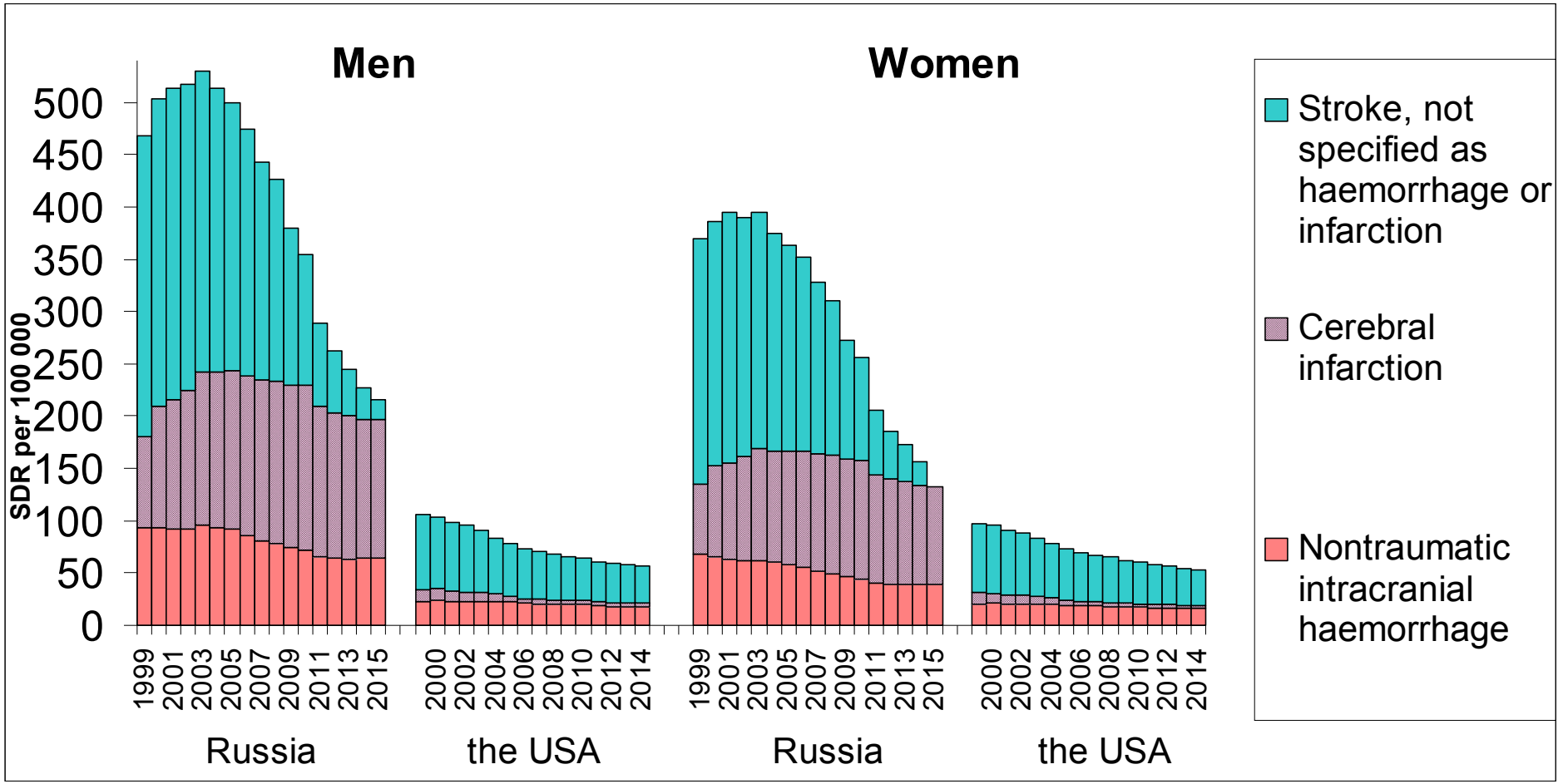
However the mortality structure and the speed of decline are quite different.

# Stroke (I60-I64)

SDR per 100 000

We considered 3 groups of diagnoses:

- Nontraumatic intracranial haemorrhage (I60-I62).
- Cerebral infarction (I63).
- Stroke, not specified as haemorrhage or infarction (I64).




It is easy to see the similarity with the previous figure. The difference is that the third of the diagnoses is used not only in Russia, but also in the USA.

# Atherosclerosis

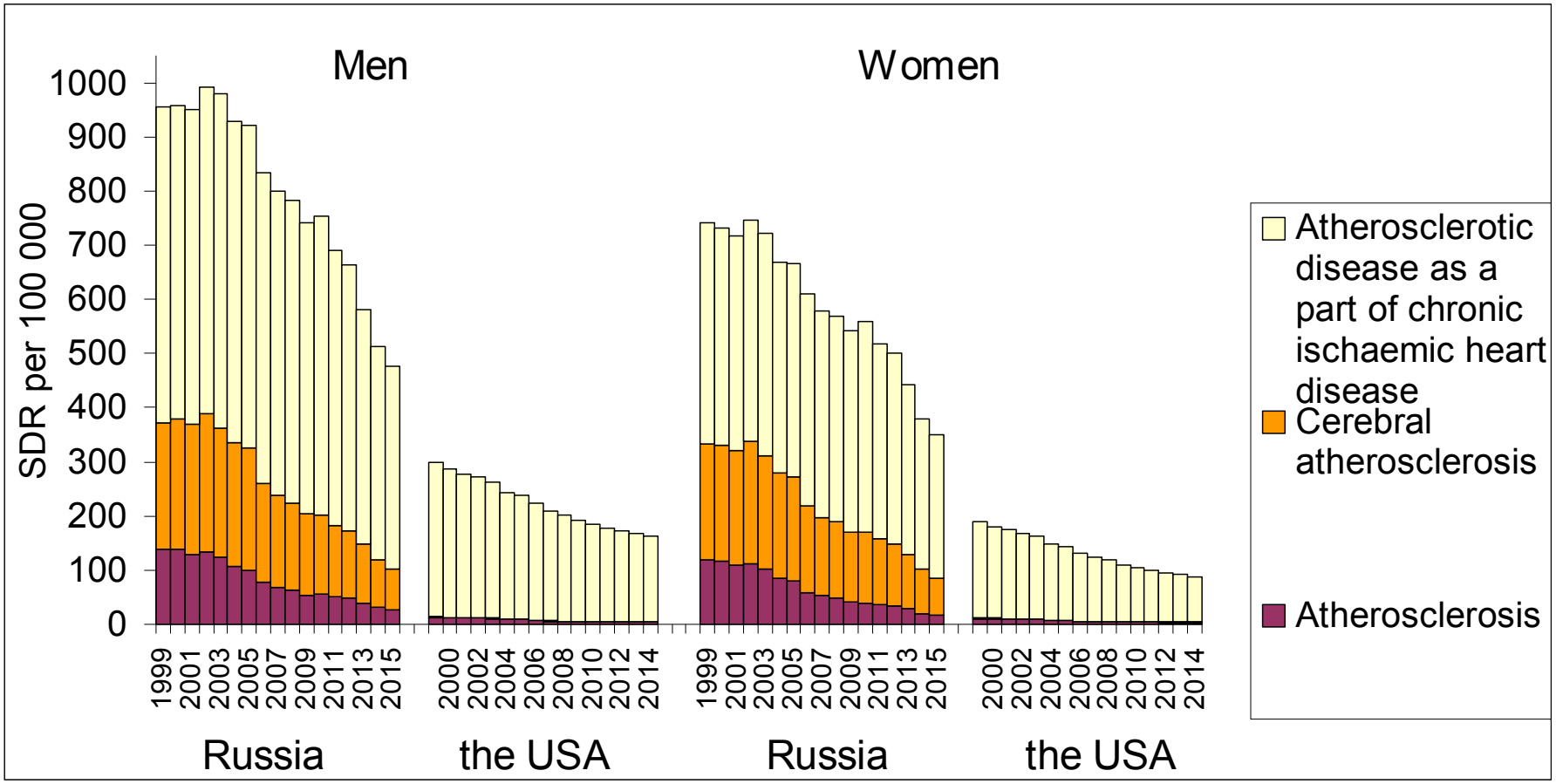
SDR per 100 000

In Russian statistics data we found 8 4-characters ICD-10 items where "sclerosis" is mentioned  In sum these causes explain 39% difference in SDR between Russia and the USA for men and 61% for women. For UK these percentages are 48 and 75 and for France  they equal 46 and 73.
We combined these causes into 3 groups.

| | Russia | USA | UK | France |
|---|---|---|---|---|
| Men | | | | |
| Atherosclerotic diseases included in chronic ischemic heart disease (I25.0, I25.1) | 539 | 205 | 76 | 14 |
| Cerebral atherosclerosis (I67.2) | 172 | 1 | 1 | 0 |
| Atherosclerosis (I70) | 77 | 7 | 2 | 2 |
| Total | 789 | 79 | 17 | 0 |
| Women | | | | |
| Atherosclerotic diseases included in chronic ischemic heart disease (I25.0, I25.1) | 372 | 120 | 32 | 6 |
| Cerebral atherosclerosis (I67.2) | 154 | 1 | 1 | 0 |
| Atherosclerosis (I70) | 62 | 6 | 2 | 1 |
| Total | 587 | 35 | 7 | 0 |

# Atherosclerosis

Graphs of the SDR changes seem very similar to the previous diagrams.




The assumption that high mortality from atherosclerosis is the result of high cholesterol in the blood, contradicts the results of many epidemiological studies. The assumption of France Meslé and Jacques Vallin that in many cases this diagnosis is a synonym for ill-defined death looks plausible. Cholesterol in the blood at the population level hardly decreased  so quickly.

# Findings

The distribution of deaths from CVD across 4th character ICD-10-codes in Russia is very differ from the same distribution for UK  the USA, and France. The existing ratios of SDR from “elementary causes“ often does not have a rational explanation. The same can be said about the age patterns of mortality for groups of causes and speed of increase in mortality with age. The dynamics of mortality from "elementary causes" often looks inexplicable and unlike the dynamics in other countries, We saw both a rapid decline and noticeable growth,
It seems likely that the same diagnoses in Russia and other countries often have different meanings. If this is true, this complicates the reduction in CVD mortality in Russia.

If a donkey is written on a cage with a lion - do not believe your eyes.

Kozma Prutkov

(a fictional author that was popular in the mid-19-century)

Thank you!