

ROAD TRAFFIC ACCIDENTS AND MORTALITY IN RUSSIA: 1956-2014*

TIMUR FATTAKHOV

This article presents for the first time an analysis of the continuous statistical data series on deaths from road accidents in Russia since 1956. The total number of deaths for 1956-2012 exceeded 1.4 million. The increase in mortality from traffic accidents started in the 1970s; since the beginning of the 1990s, the lag behind most developed countries has been growing. At 2012 mortality levels, about 85-95% of Russia's deaths from road accidents were excessive compared with the number of deaths that would have occurred at age-specific mortality rates from this cause in selected European countries. Both the current characteristics of the general level of motorisation and the main indicators of traffic injuries, such as the number of deaths per 100 thousand persons, per 10 thousand vehicles or per number of kilometres traveled, show that in terms of transport development Russia lags 40-50 years behind Western countries.

The article also examines the history of the inclusion of mortality from road accidents in the International Classification of Causes of Death (ICD) and the problems of reflecting this mortality in Russian mortality statistics.

Age and sex-specific patterns and trends in Russian mortality from traffic accidents are analysed, as well as the differences in mortality for different categories of road users (e.g. drivers, passengers and pedestrians) for the longest period possible. International comparisons that allow for understanding the extent of Russian backwardness and seeing the long-term unsustainable trends in mortality from road accidents are presented.

The author points out the necessity of further scientific research into road and transport safety problems and the development of effective safety improvement programmes in Russia aimed to overcome the lag.

Key words: motorization, traffic accidents, history of traffic accidents, deceased in an accident, ICD, external causes of death.

THE HISTORY

Road traffic accidents constitute a relatively new cause of death. Unlike homicide, suicide, poisoning and drowning, which have always existed, traffic accidents are a product of a new technological era [Vishnevsky, Fattakhov 2012].

However, the first mentions of the dangers of road transport go back to the days of antiquity. The ancient Greek myth of Phaeton, who lost control of his father's chariot, speaks to the fact that people have long known about the risks associated with the use of wheeled vehicles. There is speculation, albeit disputable, that the 19-year-old pharaoh Tutankhamun, who ruled Egypt in the 14th century BC, died from injuries caused by a fall from his chariot while hunting. In the Bible (2 Maccabees 9:7), there is a mention of the fall of Antiochus IV Epiphanes, a Syrian king: "... It happened as he was going with violence that he fell from the chariot, so that his limbs were much pained by a grievous bruising of the body". Martial (c. 40-104 AD), a Roman poet and epigrammatist, tells the story of the Greek chariot racer Scorpis, who won more than 2,000 competitions and perished in a race at the age of 27 [Martial 1968].

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In classical antiquity, people were familiar with the problems of road traffic, and there were many attempts to regulate it. For instance, Julius Caesar in his law for urban improvement (45 BC) forbade entry into Rome of all wagons between sunrise and sunset. Exceptions were made only for carts transporting construction materials for temples and public buildings and removing garbage from the city, as well as for triumphal chariots and carriages participating in ceremonial processions. In the first and second centuries, this ban was extended to all cities of Italy. Claudius issued an edict forbidding the driving of carriages through Italian cities, and Marcus Aurelius confirmed the prohibition [Sergeyenko 2000]. This nevertheless helped little. Juvenal (c. 60-127 AD) describes in one of the Satires the traffic on the streets of Rome [Juvenal 2015]:

*... The endless traffic
In narrow twisting streets, and the swearing at stranded cattle < ...>
When duty calls, the crowd gives way as the rich man's litter,
Rushes by, right in their faces, like some vast Liburnian galley,
While he reads, writes, sleeps inside, while sped on his way < ...>
Yet, he gets there first: as I hasten, the tide ahead obstructs me,
And the huge massed ranks that follow behind crush my kidneys;
This man sticks out his elbow, that one flails with a solid pole,
This man strikes my head with a beam, that one with a barrel.
Legs caked with mud, I'm forever trampled by mighty feet
From every side, while a soldier's hobnailed boot pierces my toe < ...>
Recently-mended tunics are ripped, while a long fir log judders
As it looms near, while another cart's bearing a whole pine-tree.
They teeter threateningly over the heads of those people below.
Now, if that axle breaks under the weight of Ligurian marble,
And spills an upturned mountain on top of the dense crowd,
What will be left of the bodies? What limbs, what bones will
Survive? ...*

Some medieval lawmakers acknowledged that their roads could be travelled only at a risk to their lives, and in 15th-century letters merchants emphasised that, due to road conditions and other hazards, very few people would return unscathed from a trip [Kulisher 2012]. This problem was also known in Russia. There is mention of the fact that, in the 15th century, the first rules for using postal roads were introduced. At the beginning of the 18th century, Peter I issued a decree imposing rules on how to behave while driving through the city, and the enforcement of the traffic rules was entrusted to the police [Zolotaja kniga... 2006].

By the end of the 19th century in Europe, carriage transportation reached its peak. According to rough calculations, in the last decades of the 19th century the number of animal-drawn vehicles had reached 20 million [Dolmatovsky 1986], which certainly affected the scale of traffic injuries. Thus, in Great Britain in 1875 animal-drawn transport was responsible for the deaths of 1,589 people [Cummins 2003]. In New York City in 1900, 200 people were killed by horses and carriages; in 2012 in the same city, 293 people died in traffic accidents. In 1900, the population of New York City was 3.4 million people; in 2010, it was 8.2 million – that is, mortality from traffic accidents per 100,000 at the beginning of the 20th century was about 40 percent higher than it is now [Morris 2007].

Nonetheless, it was only after the motorcar became ubiquitous that wheeled vehicles became a massive threat to people's life and health. The first car in the world was built in 1886, and the world's first traffic accident involving a car (hitting a pedestrian) happened in 1896, a decade later. The recording of road traffic accidents involving a car and leading to fatality began in 1899.

Since then, the number of traffic accidents has, unfortunately, been constantly growing. When cars crash, injuries are commonplace and people are often killed. In terms of the number of victims, traffic accidents are considered to be one of the most dangerous external causes of death in the world. In addition, they are a major cause of disability, since for every case of death from a road accident there are many times more injured survivors [Vishnevsky 2010]. In 1974, the World Health Assembly (WHA) adopted resolution WHA 27/59, which declared road traffic accidents to be a major public health problem.

In Russia, the process of motorisation began at a time when there were already hundreds of thousands of cars in the West. The first cars appeared in Russia in the early twentieth century. Prior to the 1970s, the number of passenger cars produced was smaller than that of trucks, which was quite unusual for countries with high levels of motorisation. The turning point came only after the commissioning in 1971 of the Volga Automobile Plant (VAZ) in Togliatti. If, in 1970, Russia produced 257,000 cars and 445,000 trucks, by 1975 the ratio had become quite different: 1,066,000 cars and 591,000 trucks. From that point onward, there was a considerable expansion of the car market and of the real motorisation of the USSR and, later, Russia (see Figure 1).

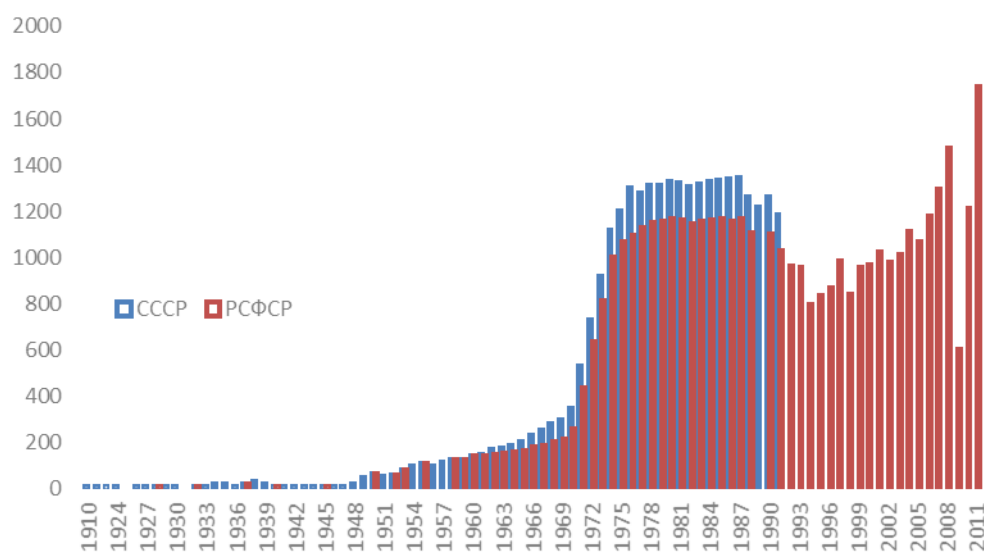


Figure 1. Production of passenger cars in the USSR and Russia, thousands

Source: [Narodnoe khozyajstvo SSSR (1958-1990); Rosstat (1995-2014)]

In 2012, there were 38.7 million passenger cars in Russia. From 2000 to 2012, the share of cars in the structure of motor vehicles increased from 64.6% to 80.9% (Figure 2).

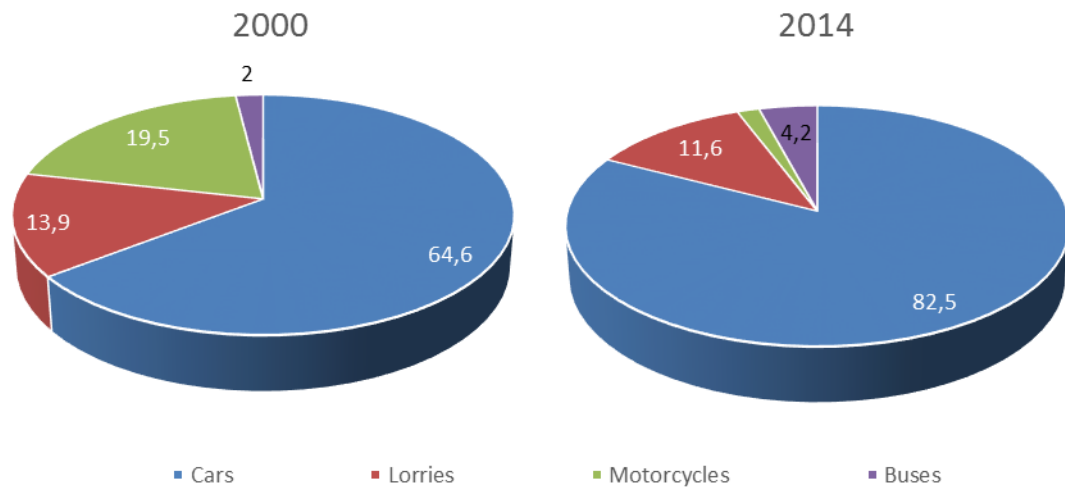


Figure 2. The structure of Russian motor vehicles in 2000, 2014, %

Source: [STSI ...].

The growth of the car fleet in recent decades is largely due to foreign cars. So, if in 1999 there were only 4.2 million foreign cars in Russia, in 2012 there were already 17.7 million (Figure 3). In 1999, only one in every five cars in the country was of foreign origin, in 2012 – almost one in two (45.6%).

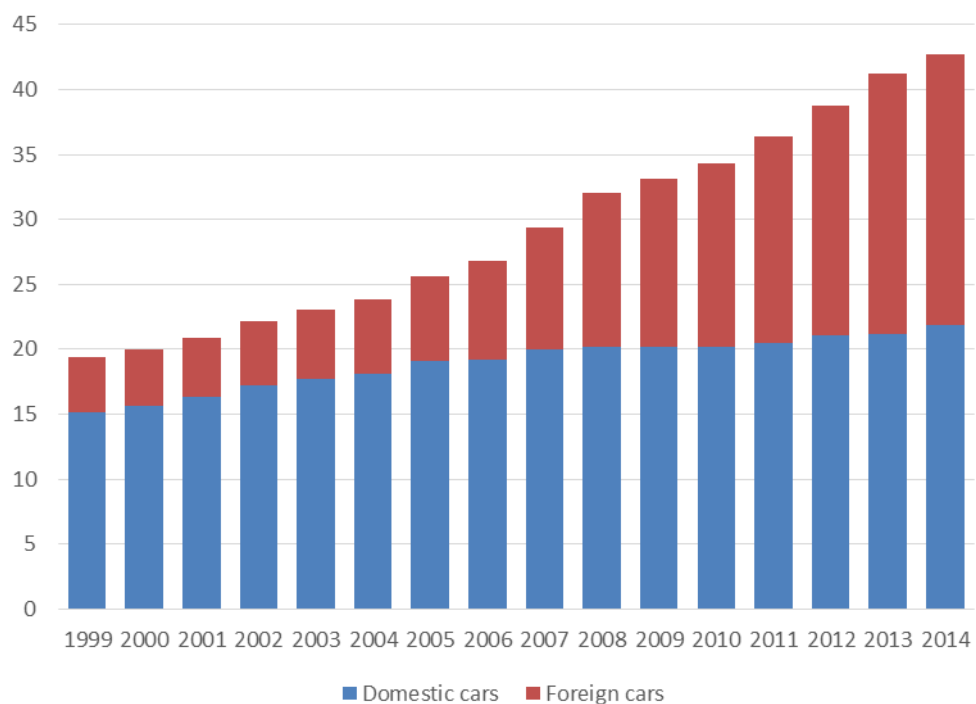


Figure 3. Growth in the number of cars in Russia in 1999-2014, millions

Source: [STSI ...].

Accordingly, from 1999 an increase in the share of road traffic injuries in the overall mortality structure began. Road traffic injuries had, of course, occurred in Russia before, but the

losses associated with it are not comparable with those that happened 20-30 years later, despite the currently relatively low – by world standards – level of motorisation. As the authors of an article on the consequences of traffic accidents in Russia wrote in the early 2000s, while the number of cars per 1,000 inhabitants did not reach even 150, “There is an impression that Russia aims to compensate for the small number of cars with a large number of fatalities per each of them” [Revich, Reshetnikov 2001]. Since then, the number of passenger cars per 1,000 inhabitants in Russia has doubled, and the problem of traffic accidents and their consequences, including mortality due to them, has become even more important.

TRAFFIC ACCIDENTS IN THE INTERNATIONAL CLASSIFICATION OF DISEASES (ICD) AND THE RUSSIAN NOMENCLATURE OF THE CAUSES OF DEATH

Awareness of the importance of road traffic injuries as both a factor affecting health and a cause of death can be traced in the International Classification of Diseases, Injuries and Causes of Death. This awareness did not come immediately. In the first edition of the International Classification of Diseases, Injuries and Causes of Death adopted in 1900, in the category of “violent death”, traffic accidents do not stand out and are, correspondingly, included in the group of “other external causes”. The role of motor transport as a source of danger to life and limb was still a minor one; people still were dying mostly under the wheels of carriages, coaches and carts (Table 1).

The following editions (ICD-2-3) still identified road traffic accidents not as a separate cause of death, but included them in the category of “violent deaths”, together with certain natural disasters: “Injuries and other severe injuries (cars, railways, water transport, landslides, etc.)” [International Statistical ...].

The fourth edition did not include traffic accidents in the main list of causes of disease and death, but recommended keeping separate records of them. It was recommended to record separately rail transport, cars and motorcycles, other means of vehicular transport, water transport and air transport.

Major changes were introduced to the international list of causes of death in the fifth edition (1938). For the first time, a separate category related to traffic accidents appeared in the list. It included nine causes, one of which was designated as “road traffic accidents” [International Statistical ...]:

- Railway accidents (any cause of death except war),
- Motor vehicle accidents (any cause of death except war),
- Collisions with trains,
- Collisions with trams,
- Other motor vehicle accidents,
- Tramway accidents on roads (any cause of death except war),
- Other road traffic accidents (any cause of death except war),
- Water traffic accidents (any cause of death except war),
- Air traffic accidents (any cause of death except war).

Table 1: Classification of traffic accidents in the ICD-1 – ICD-5

	Traffic accidents	Road traffic accidents
ICD-1 (1900)	Not singled out Traffic accidents included in cause 166 “Other external causes”	Not singled out
ICD-2 (1909)	Not singled out Traffic accidents included in cause 175 “Accidental injury by other forms of crushing (road vehicles, on railways, etc.)”	Not singled out
ICD-3 (1920)	Not singled out Traffic accidents included in cause 188 “Accidental injury by other forms of crushing (road vehicles, on railways, etc.)”	Not singled out
ICD-4 (1929)	Not singled out, but there is a recommendation to record such incidents	Not singled out, but there is a recommendation to record such incidents
ICD-5 (1938)	169-173	170-171

Subsequent revisions of the International Classification of Diseases and Related Health Problems, published in the post-World War II period, demonstrated a fairly clear awareness of the car as a serious source of danger to life and limb. In the 6th-9th editions, there is a separate group of causes of death and injuries resulting from traffic accidents, “Car accidents” (Table 2).

Table 2. Classification of accidents in ICD-6 - ICD-9

Revision 6 (1948)	Revision 7 (1955)	Revision 8 (1965)	Revision 9 (1975)
Railway accidents (E800-E802)	Railway accidents (E800-E802)	Railway accidents (E800-E807)	Railway accidents (E800-E807)
Motor vehicle traffic accidents (E810-E835)	Motor vehicle traffic accidents (E810-E835)	Motor vehicle traffic accidents (E810-E823)	Motor vehicle traffic accidents (E810-E825)
Other road vehicle accidents (E840-E845)	Other road vehicle accidents (E840-E845)	Other road vehicle accidents (E825-E827)	Other road vehicle accidents (E826-E829)
Water traffic accidents (E850-E858)	Water traffic accidents (E850-E858)	Water traffic accidents (E830-E838)	Water traffic accidents (E830-E838)
Aircraft accidents (E860-E866)	Aircraft accidents (E860-E866)	Air and space traffic accidents (E840-E845)	Air and space traffic accidents (E840-E845)

In the currently used ICD-10, road traffic accidents occupy a central place in the category “Traffic accidents” (V01-V99) of class XX, “External causes of morbidity and mortality”, with eight of the category’s 12 groups devoted to it (Table 3).

Groups related to accidents connected with ground transportation (V01-V89) indicate the type of transport and the category of the victim; in addition, they have subcategories for the identification of a different road user or type of accident.

The codes for the majority of traffic accidents are built according to particularly designated characters in the code with a set of features. The letter V represents traffic accidents. The second sign provides information about the victim (0 – pedestrian, 1 – bicyclist, 2 – motorcyclist, etc.). The third code symbol indicates into what the victim ran (01 – bicycle, 02 – two or three-wheeled motor vehicle, etc.). Information about whether the traffic accident took place on or off of a road

is provided in the fourth symbol. For instance, the code V03.1 would mean that there was a traffic accident (V) in which a pedestrian (0) was hit by a car (3) in a road traffic accident (1).

Table 3. Structure of traffic accidents in the ICD-10

V01-V09	Pedestrian injured in a traffic accident
V10-V19	Pedal cyclist injured in a traffic accident
V20-V29	Motorcycle rider injured in a traffic accident
V30-V39	Occupant of three-wheeled motor vehicle injured in a traffic accident
V40-V49	Automobile occupant injured in a traffic accident
V50-V59	Occupant of a pick-up truck or a van injured in a traffic accident
V60-V69	Occupant of a heavy transport vehicle injured in a traffic accident
V70-V79	Bus rider injured in a traffic accident
V80-V89	Other land traffic accident
V90-V94	Water traffic accident
V95-V97	Air and space traffic accident
V98-V99	Other and unspecified traffic accident

Table 4. List of detailed causes of death in traffic accidents in accordance with the concise list in use in the USSR and Russia

Period	Causes
1956-1998	Motor vehicle traffic accident
	Motor vehicle traffic accident involving collision with a pedestrian
	Other traffic accident
1999-2005	Pedestrian injured in a traffic accident
	Automobile occupant injured in a traffic accident
	Other and unspecified traffic accident
	Pedestrian injured in a traffic accident
2006-2010	Automobile occupant injured in a traffic accident
	Other and unspecified traffic accident
	Pedestrian injured in a collision with motor vehicle, a non-traffic accident
	Other people injured in a collision with motor vehicle, a non-traffic accident
	Other traffic accident
	Pedestrian injured in a traffic accident (except rail)
	Cyclist (any), a motorcyclist and a person in a three-wheeled vehicle injured in a road traffic accident
	Person found in a vehicle injured in a road traffic accident
	Pedestrian injured in a non-traffic accident (except rail)
	Cyclist (any), a motorcyclist (any) and a three-wheeled vehicle rider injured in a non-traffic accident
2011 onward	Person found in a vehicle injured in a non-traffic accident
	Pedestrian injured in a collision with a train or other railway vehicle
	Pedestrian injured in an unspecified traffic accident (except rail)
	Immersion in water and drowning in an accident on a watercraft
	Immersion in water and drowning related to water transport not associated with an accident on it
	Other and unspecified accident in water transport
	Accident in air transport and space travel
	Other and unspecified traffic accident

In the practice of Russian public statistics, mortality data are processed with the International Classification in mind, but according to an abbreviated nomenclature which is periodically revised. With the transition of Russia to the ICD-10 in 1999, data on road traffic mortality was no longer assigned to a separate cause. This is primarily due to the appearance of a more detailed list of separate causes of death and a new formulation of a road accident. The World Health Organisation (WHO) has developed specific recommendations as to which transport causes of death (in accordance with the new ICD-10 coding) should be categorised as road traffic accidents. In Russia, unfortunately, this recommendation is not followed. In 2005 and 2011, the

Ministry of Health of the Russian Federation reviewed the list of causes of death in use in Russia. Since 2011, 13 transport causes of death have been identified (codes 256-268).

Table 5. ICD-10 codes recommended by WHO to determine road traffic accidents and codes of traffic accidents used in Russia

WHO recommendation	Recommendations for Form 57 "Information on injuries, poisoning and other certain consequences of external causes"
V02-V04; V09; V12-V14; V20-V79; V82-V87; V89	V01.1; V02.1; V03.1; V04.1; V09.1; V09.3; V83.2; V84.2; V85.2; V86.2; V10.3-9; V11.3-9; V12.3-9; V13.3-9; V14.3-9; V15.3-9; V16.3-9; V17.3-9; V18.3-9; V19.4-9; V20.3-9; V21.3-9; V22.3-9; V23.3-9; V24.3-9; V25.3-9; V26.3-9; V27.3-9; V28.3-9; V29.4-9; V30.4-9; V31.4-9; V32.4-9; V33.4-9; V34.4-9; V35.4-9; V36.4-9; V37.4-9; V38.4-9; V39.4-9; V40-V79 (.4-.9)

Depending on the availability of statistical data on deaths from traffic accidents, a rough division into four periods can be made according to the number of detailed causes of death: 1956-1998, 1999-2005, 2006-2010 and the current period starting in 2011 (Table 4). Table 5 compares the ICD-10 codes recommended by WHO for the classification of road traffic accidents with the codes used in Russia.

MORTALITY FROM ROAD TRAFFIC ACCIDENTS IN RUSSIA AND ITS PLACE IN THE STRUCTURE OF TOTAL MORTALITY AND MORTALITY FROM EXTERNAL CAUSES

As was noted, for Russia there is a high number of deaths from road traffic accidents, as well as from other causes of death, beginning from 1956. From 1956 to 1998, the sum of "accidents related to motorised vehicles" and "traffic accidents on a public road as a result of a collision with a pedestrian" gave the total number of people killed in traffic accidents. Due to repeated changes in the nomenclature of the causes of death, the data for different periods are not quite comparable, and to ensure the comparability of the Russian indicators with each other and with the indicators of other countries, special work was needed to reconstruct comparable time series of deaths (including road traffic accidents). The most famous reconstruction of the time series of deaths by causes of death (including traffic accidents) relates to the 1965-1994 period [Meslé F. et al 1996]. A few years later, the same authors, joined by E.M. Andreev, extended the series back to 1956. For the years 1995-1998 there are the same data, calculated by E.M. Andreev based on official mortality statistics.

Data on road traffic accidents and their consequences in Russia are published in various statistical reports, available in international databases and referred to in various studies (Table 6).

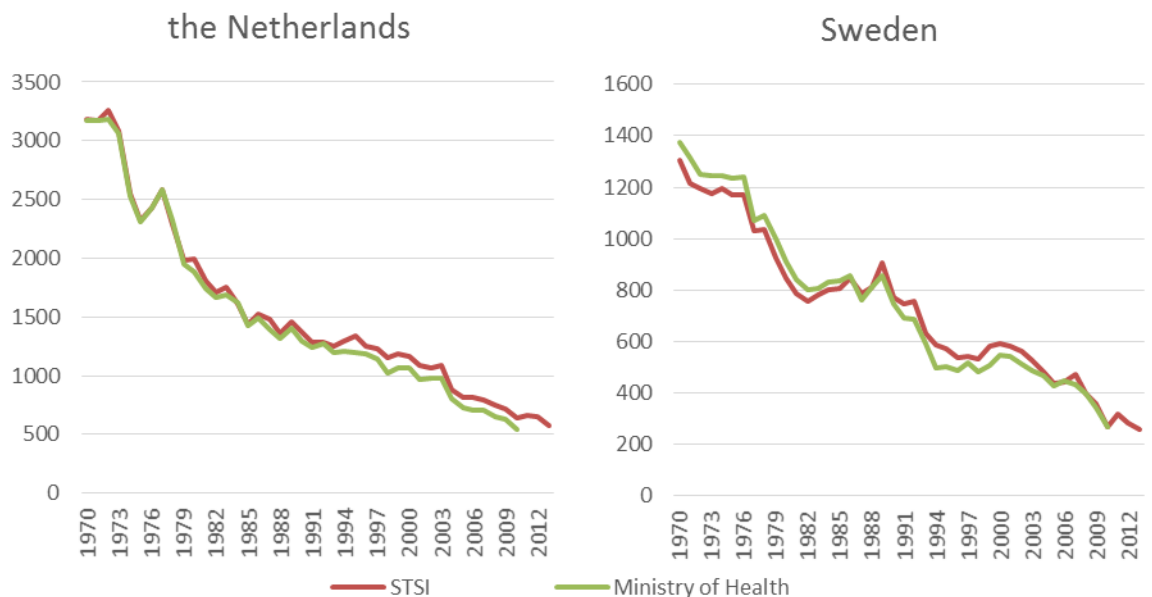
Today, police reports are the main source of information on road traffic accidents in most developed countries (90 percent) [Derriks, Mak 2007], including Russia. Medical reports are an auxiliary source of information.

In almost all countries, there are differences between the data of the Ministry of Public Health and that of the police. The differences are usually minimal and only in rare instances exceed 6-7 percent (Figure 4).

Table 6. Sources of information of traffic fatalities in Russia

Publication or Database	Data Type	Source	Period Covered
[Rosstat (1991-2013)]	Open	State Traffic Safety Inspectorate (STSI)	1991-2013
[Rosstat (1980-2013)]	Open	STSI	1980-2013
[Rosstat (2006-2013)]	Open	Rosstat	2006-2013
[Rosstat (1997-2013)]	Open	STSI	1997-2013
[Rosstat (1990-2013)]	Open	STSI	1990-2013
[Rosstat (2000-2013)]	Open	STSI	2000-2013
[Rosstat (1995-2014)]	Open	STSI	1995-2014
[WHO Mortality Database]	Open	Rosstat	1980-1998
[Database of the United Nations]	Open	STSI	1993-2012
Non-personal data*	Closed	Rosstat	1999-2014
[Form №40]	Closed	Ministry of Public Health	1999-2014
[Meslé, Vallin... 2003]	Open	Rosstat adjusted by E.M. Andreev et al	1956-1964
[Meslé, Vallin... 1996]	Open	Rosstat	1965-1994
[Russian database...]	Open	Rosstat	1995-1998

* Anonymous microdata on all cases of death collected by territorial offices of Rosstat and containing information on sex, exact date of birth, date of death and the cause of death are in accordance with ICD-10

**Figure 4. Differences between agency data in Sweden and the Netherlands, 1970-2013, people**

Source: [OECD...; WHO Mortality Database]

What distinguishes Russia is the scale of interdepartmental differences (25-30 percent), which is not typical of other countries. The magnitude of underreporting of traffic fatalities allowed by the Ministry of Public Health is striking when compared to the data on fatalities from the Russian Demographic Yearbook and the STSI (Figure 5).



Figure 5. Road traffic fatalities data from Rosstat and STSI, 2006-2014, thousands

Source: [STSI...; Rosstat (2006-2013)]

A reconstruction of the number of fatalities from 1956 to 2012 compiled from all available sources is illustrated in Figure 6. It is evident that the data from the Ministry of Public Health and the STSI coincided until 1998. From 1999 to 2005, the Ministry of Public Health did not publish data on road traffic fatalities (during this period only STSI data were published). Such data appeared only in 2006 in the Russian Demographic Yearbook, and it is precisely in this year that a discrepancy between the data of the two agencies appeared. This discrepancy has never been eliminated. It is also clear what would have resulted if, starting in 1999, Russia had adopted WHO recommendations for defining a road traffic accident according to the ICD-10. In this case, the interagency differences in data on road traffic fatalities would have been reduced to a minimum (non-personalised data line).

Despite the differences in the data, the trend in road traffic mortality is clear. From 1956 to 1980, the number of deaths from traffic accidents grew steadily, went down for a short time during the anti-alcohol campaign and *perestroika* era (1985-1987), and after the end of the campaign resumed growth, reaching a historic high in 1991. This was followed by a decrease and a new resurgence after 1998 which peaked in 2003. This rise turned out to be short-lived, since after 2003 the declining trend (albeit with insignificant fluctuations) resumed.

The dynamics of mortality from road traffic accidents in Russia have been markedly different from those in developed countries, firstly by their extremely high level and secondly by their pendulum-like behaviour. According to the available WHO data, road traffic fatalities in developed countries had been growing until the early 1970s. The reduction of mortality in these countries began in the late 1960s and early 1970s. The ups and downs of traffic mortality observed in Russia are not characteristic of developed countries, where such mortality has been steadily declining.

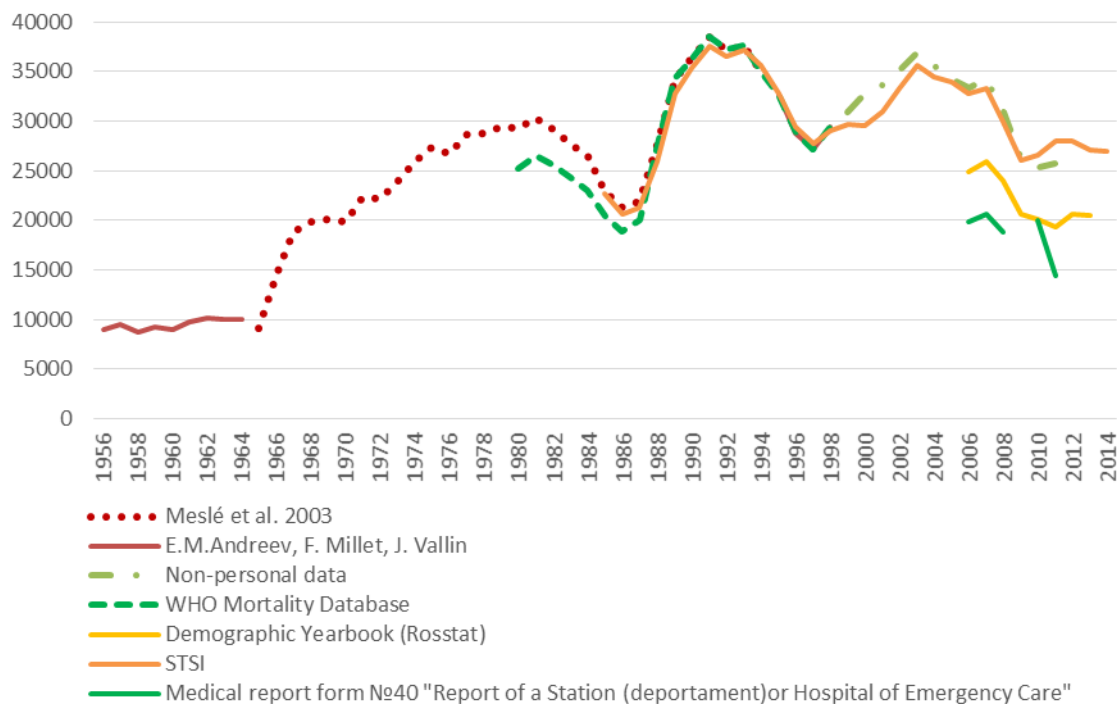


Figure 6. Reconstruction of the numbers of road traffic fatalities in Russia, 1956-2014, people

In the 2000s, the number of road traffic fatalities in Russia resumed its decline, but the gains were smaller than in other countries. At the same time, the number of road traffic accidents and the number of people injured in Russia grew, whereas in most other countries they fell [Vishnevsky, Fattakhov 2012]. Russia, even taking into account the decline observed in recent years, is at a level that had already been reached by developed countries in the 1980s [Fattakhov 2014]. Accordingly, Russia's lag behind other countries remains significant. For instance, in 2010 the difference between Russia and leading economies (e.g. Sweden, the Netherlands, the UK, etc.) was six-fold. It should also be noted that the oscillatory movement of the level of road traffic fatalities observed in Russia during the last four decades does not allow us to determine with certainty whether the observed reduction in mortality will be interrupted by yet another rise or not (Figure 7).

Road traffic accidents and their consequences – the inevitable companions of motorisation – present a serious social and health problem worldwide. But in Russia, when compared with countries of similar levels of development, this problem is particularly acute. In a number of strategic documents, road safety issues are identified as priorities of socio-economic development. In his 2013 address to the Federal Assembly, President Vladimir Putin called the implementation of safety improvement programmes one of the urgent tasks for the country [*Obshchestvennyj doklad* 2014]. This interest in the problem is not accidental. The social and economic costs of traffic accidents and their consequences for the 2004-2011 period are estimated at 8.18 trillion roubles, which is comparable to the total of budget receipts of all regions of Russia in 2012 [*O federalnoy tselevoy ...* 2014].

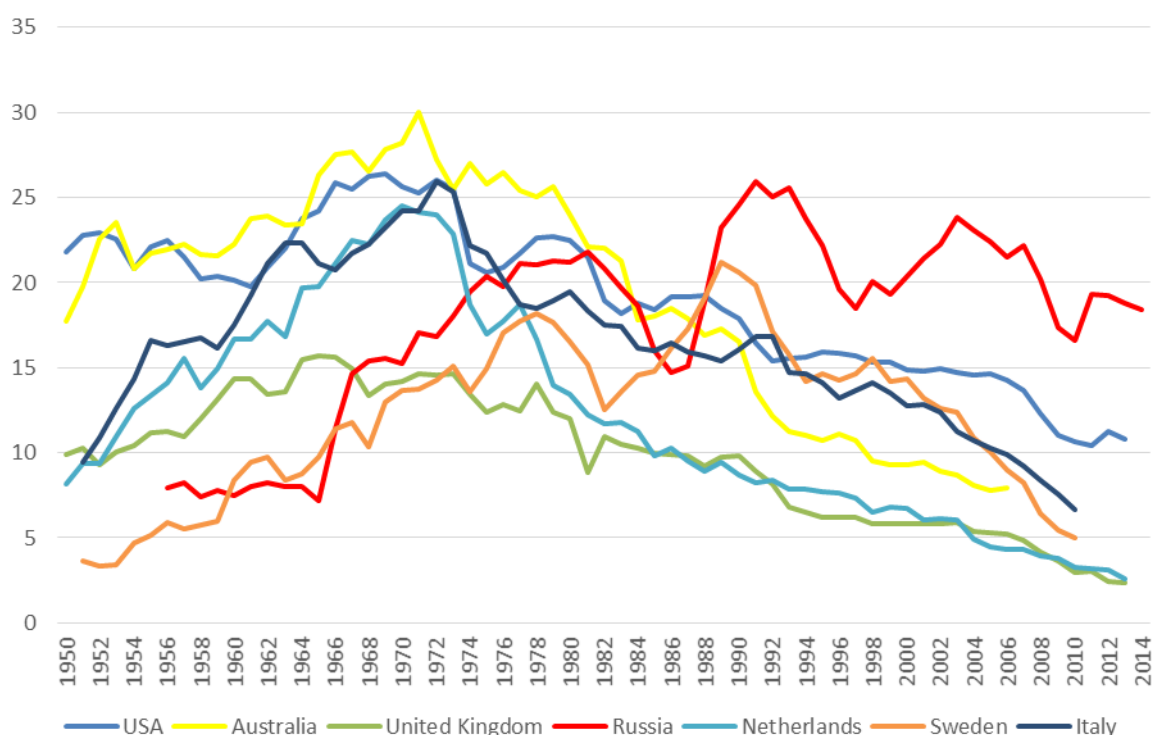


Figure 7. Standardised mortality rates from traffic accidents in Russia and selected developed countries, 1950-2014, per 100,000

Source: the author's calculations based on [WHO Mortality Database] and reconstructed data on mortality from road traffic accidents

According to Rosstat, 1,411,000 people died in road traffic accidents in Russia from 1956 to 2012. According to traffic police data, the cumulative number of road traffic accidents with victims surpassed 5 million in 1985-2012; 856,400 people died and more than 6 million received injuries of varying severity. About 40 percent of these injuries can be considered minor, while the other 60 percent can be classified as serious (e.g. open wounds, concussions, broken bones, internal injuries, burns, etc.) [Form № 57 ... 2011]. As a result of road traffic accidents, 6,000 people per year become disabled (groups I, II and III) [Form № 7 ... 2011]. According to the Russian Ministry of Public Health, overall mortality from traffic accidents is 12 times higher than from injuries resulting from other accidents, the disability rate is six times higher, and the need for hospitalisation is seven times more frequent [O federalnoy tselevoy... 2014].

If Russians died from road traffic accidents at the same rate as, for instance, the Swedes, the number of people killed in 2012 would have been not the actual 27,991, but 3,627 (Table 7). The total population loss between 1990 and 2012 would have been not 744,000, but 194,000. Excess mortality in this case would have reached 550,000 people, or 25,000 per year.

Other methods can also be used for estimating excess losses. Thus, if we use not the number of deaths per 100,000, but the number of deaths per kilometer of roadway, it turns out that by Swedish standards, not 28,000 people would have been killed in road traffic accidents in Russia in 2012, but 1,146 (Table 7).

To complete the picture, we also use the indicator of transportation risks (i.e. the number of deaths per 10,000 cars). If in Russia in 2012 the number of deaths per 10,000 cars had been the same as in Sweden, mortality from road traffic accidents would have come to 1,683 people (see Table 7), and total excess deaths from 1990 to 2012 would have been reduced to 696,000. Table 7 presents such comparisons with three countries – the United Kingdom, the Netherlands and Sweden.

Table 7. Hypothetical number of deaths from road traffic accidents in Russia in 2012 at the mortality level of three developed countries according to selected indicators, and excess deaths due to the higher mortality in Russia

Indicator	Hypothetical number of deaths at mortality levels of:			Excess number of deaths in Russia in comparison with the hypothetical number of deaths at mortality levels of:		
	United Kingdom	Netherlands	Sweden	United Kingdom	Netherlands	Sweden
Fatalities per 100,000	3945	4088	3627	24046	23903	24364
Fatalities per 10,000 vehicles	1930	1965	1683	26061	26026	26308
Fatalities per 1,000 km of roadway	4451	4199	1146	23540	23792	26845

As can be seen in Table 7, different ways of estimating excess Russian mortality when comparing Russia to several countries do not produce exactly the same results, but the differences are not fundamental. With the actual number of deaths from road accidents in Russia in 2012 at about 28,000, the numbers between 23,500 and 26,800 (84-86%) were excessive; at the mortality rates from road accidents typical for Western European countries, these might never have occurred.

Of course, such a comparison is rather conditional; at present, it is hardly possible to achieve such results in Russia. Nevertheless, it points to the huge unused reserves for reducing mortality from road accidents and testifies to the fact that such a reduction is in principle possible.

Road traffic accidents account for 1.5 percent of all deaths in Russia. The proportion of deaths due to traffic accidents in the overall structure of external causes of death varies, sometimes reaching a fairly high value, as was the case, for instance, in the late 1980s and early 1990s (18 percent), but these fluctuations are generally in the range of 10-14 percent (Figure 8).

Mortality from road traffic accidents contributes significantly to mortality from all external causes of death, but traffic accidents do not play the leading role in the structure of mortality from these causes. During the second half of the 20th century, the major external causes of death in Russia were suicide, murder and alcohol poisoning. In recent years, there has been an increase in the number of injuries with uncertain intent [Vasin, Krenev 2012]. On the whole, the dynamics of all the main causes of this class are similar (Figure 9).

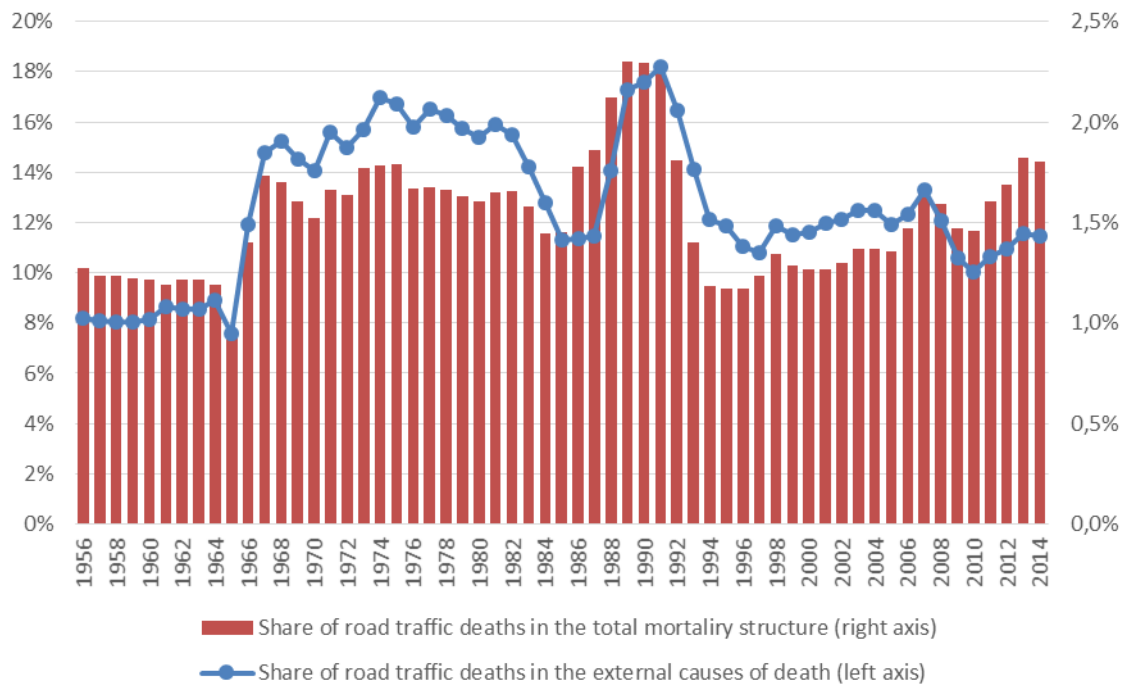


Figure 8. Share of road traffic fatalities in the total number of deaths (right axis) and in the number of deaths from external causes (left axis), 1956-2014, percent

Source: the author's calculations based on the reconstructed data on mortality from road traffic accidents

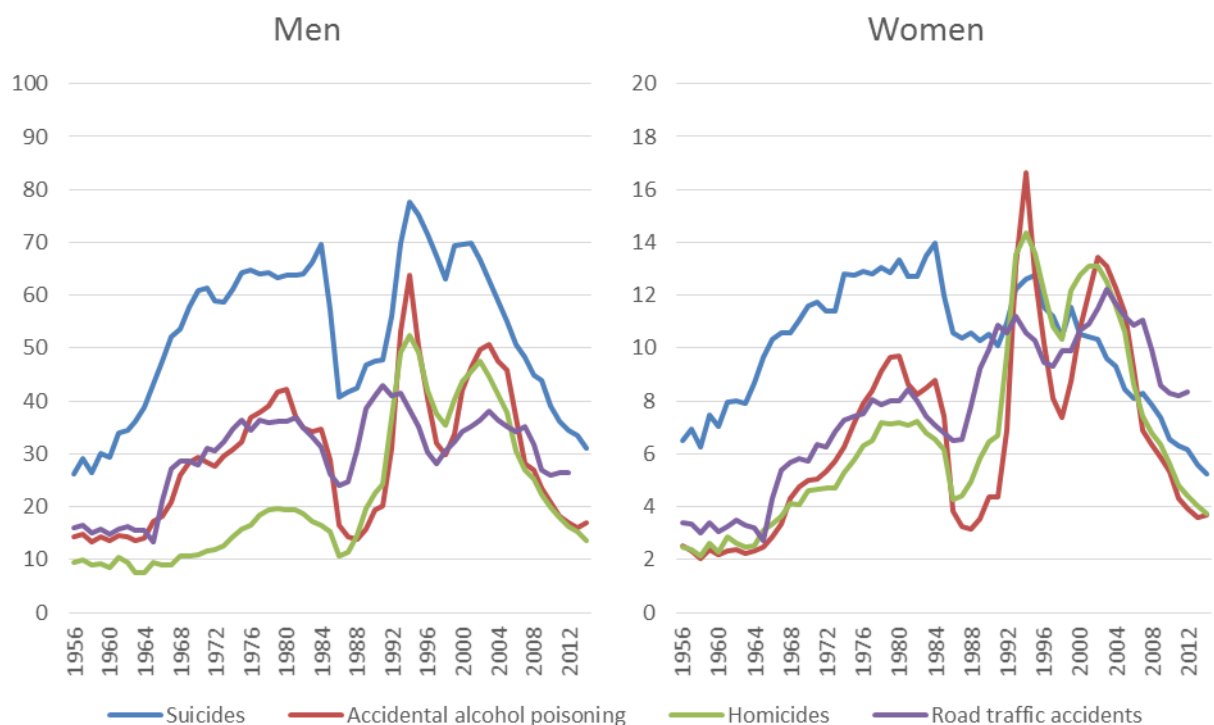


Figure 9. Standardised death rates from selected external causes of death in Russia, 1956-2014, per 100,000

Source: the author's calculations based on the reconstructed data on mortality from road traffic accidents

In 2012, road traffic accidents accounted for 14.4 percent of deaths from external causes. More people died from suicide, injuries with uncertain intentions and accidental alcohol poisoning (Figure 10).

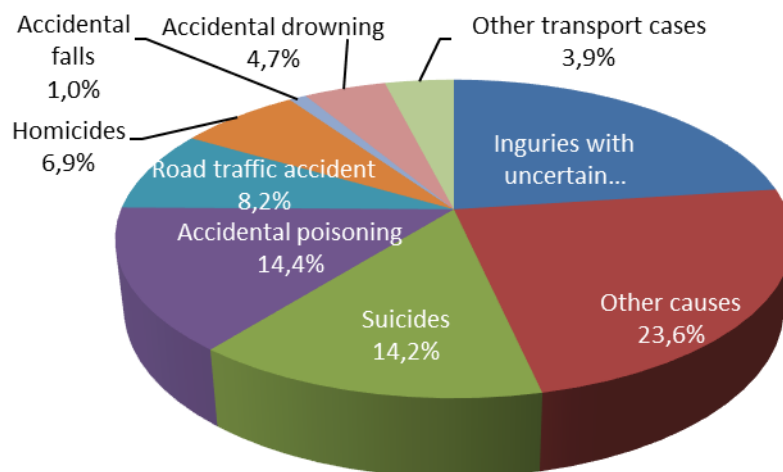


Figure 10. Distribution of the number of deaths from external causes by categories in Russia, 2014, percent

Source: [Rosstat (2006-2013)]

The proportion of deaths from road traffic accidents in external causes of death varies among countries. In Greece, road traffic mortality constitutes nearly 40 percent of all external causes. The lowest proportions are observed in the Scandinavian countries and Japan (Figure 11). On the graph, Russia occupies a middle position, but one must take into account that the overall mortality rate from external causes in Russia is usually much higher than in the countries cited.

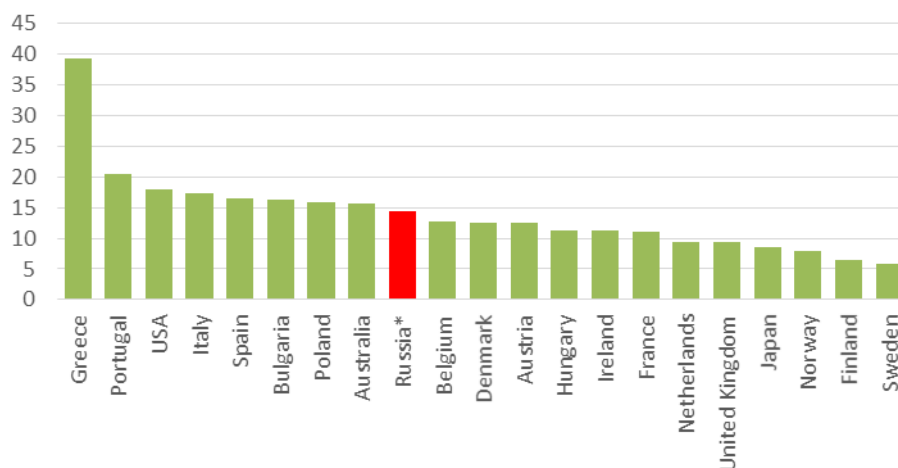


Figure 11. Percentage of deaths from traffic accidents in the external causes of death in selected countries, 2013

Source: [WHO Mortality Database], * STSI

Road traffic accidents hold a leading position in the structure of transportation mortality. They account for 80-90 percent of all deaths from traffic accidents, and according to this indicator Russia also does not differ from other countries (Figure 12).

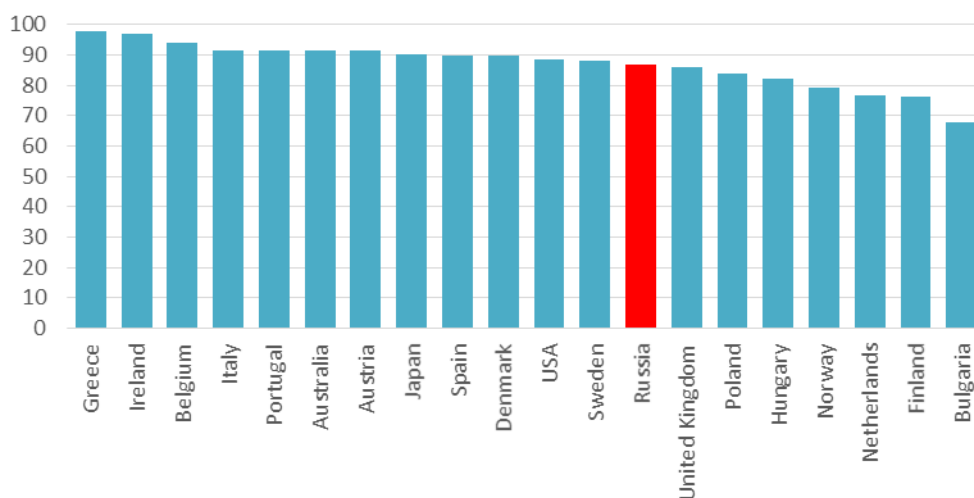


Figure 12. Share of deaths from road traffic accidents in the total number of deaths from traffic accidents in selected countries, 2012, percent

Source: [WHO Mortality Database]

AGE AND SEX DISTRIBUTION OF DEATHS IN ROAD ACCIDENTS

Mortality from road traffic accidents in Russia demonstrates both sex and age differences common to all countries, as well as distinguishing features characteristic only of Russia. Male and female mortality in Russia and Western Europe can be compared using the standardised mortality rate (SMR) from road traffic accidents. In Russia in the early 1970s, the rate was lower than in Western Europe. The decrease in mortality from road traffic accidents in Western Europe and its simultaneous increase in Russia reversed and widened the gap. In the early 1980s, mortality from road traffic accidents in Russia began to decline among both men and women, and by the mid-1980s it reached the European average, after which it rose even more sharply; in Europe, on the other hand, the standardised mortality rates from traffic accidents decreased steadily. In the last decade, the rates have converged somewhat, but this is in fact nothing more than a return to the level of the mid-1990s; the lag behind the countries of Western Europe remains (Figure 13).

In all countries and in all age groups, mortality from traffic accidents among men is 2.5-3 times higher than among women. As might be expected, this difference is not found in infants, but in the age group 1-4 mortality is already higher in boys. Among children aged 5-14, the ratio of the indicators for males and females is about 1.5-2.0 to 1; in the age groups 15-29 and 30-44 the ratio is 3-5 to 1; in the group 45-59, it decreases to 3.5 to 1, and then rebounds in the age group 65 and older. The similarity of the rates in all countries for the age groups 1-4, 5-14 and 65 and older is highly significant (Figure 14).

In Russia, the age profile of mortality has been changing continuously since the 1960s, gradually taking the form of a curve with a pronounced hump in mortality among youth. The mortality curve from road traffic accidents shows steep increases in age groups 15-24 and 75 and over. The maximum values of these indicators are evident in men, but significantly less so in women, especially in the age group 15-24. The age profile of male mortality from traffic accidents

in Russia peaked in the early 1990s, while in women the maximum was reached in the 2000s (Figure 15).

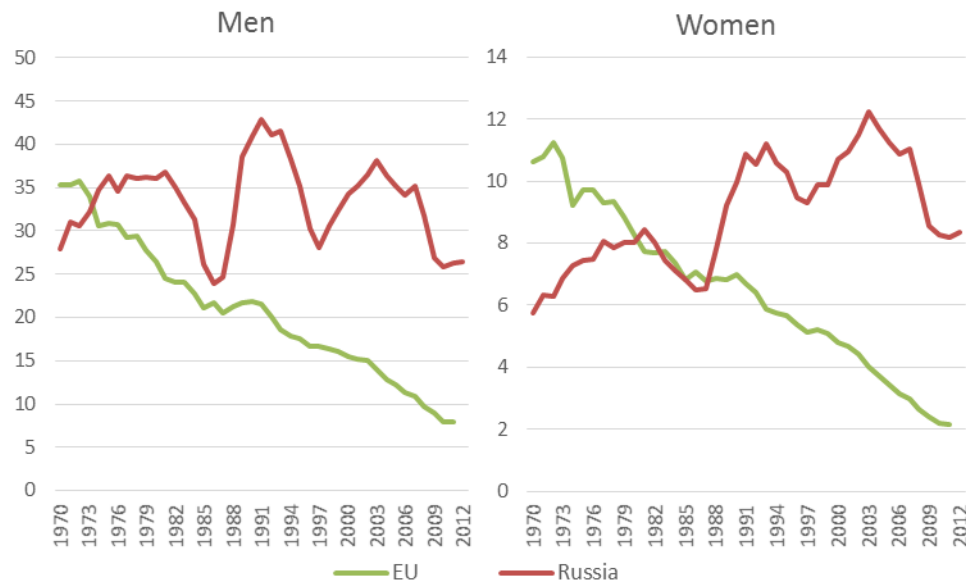
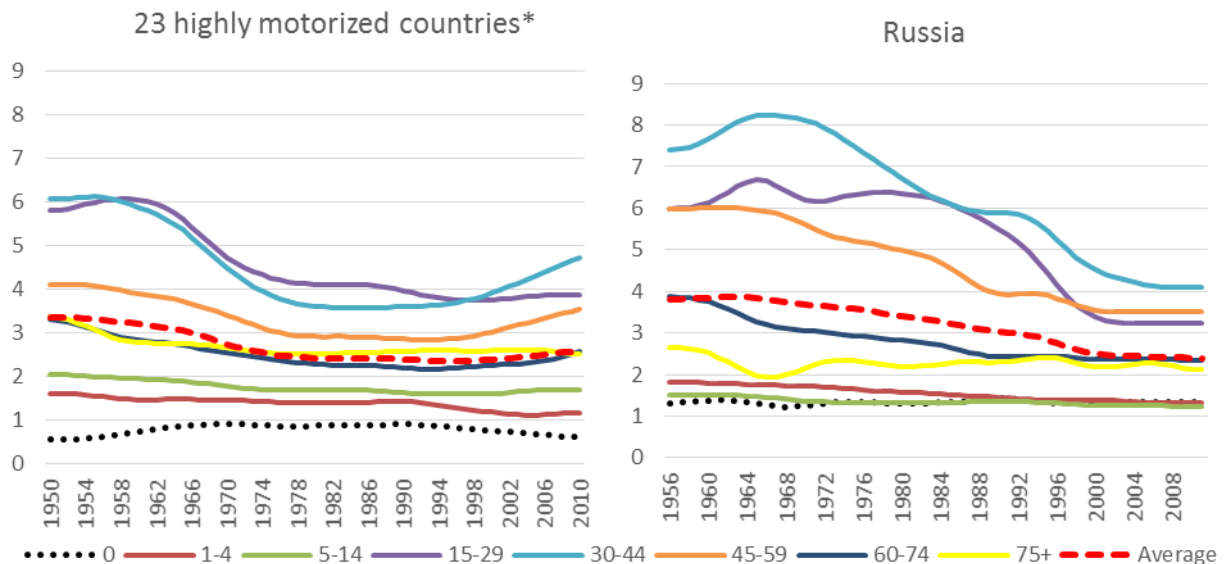


Figure 13. Standardised death rates from traffic accidents by sex, 1970-2013, per 100,000

Source: the author's calculations based on [WHO Mortality Database] and reconstructed data on mortality from road traffic accidents



*Australia, Austria, Belgium, Bulgaria, Canada, Denmark, Finland, France, Greece, Hungary, Iceland, Ireland, Italy, Japan, the Netherlands, New Zealand, Norway, Poland, Portugal, Spain, Sweden, the United Kingdom and the United States.

Figure 14. Sex ratio in mortality from road traffic accidents in different age groups, 23 highly motorised countries and Russia, 1950-2011, male deaths per one female death

Source: the author's calculations based on [WHO Mortality Database] and reconstructed data on mortality from road traffic accidents

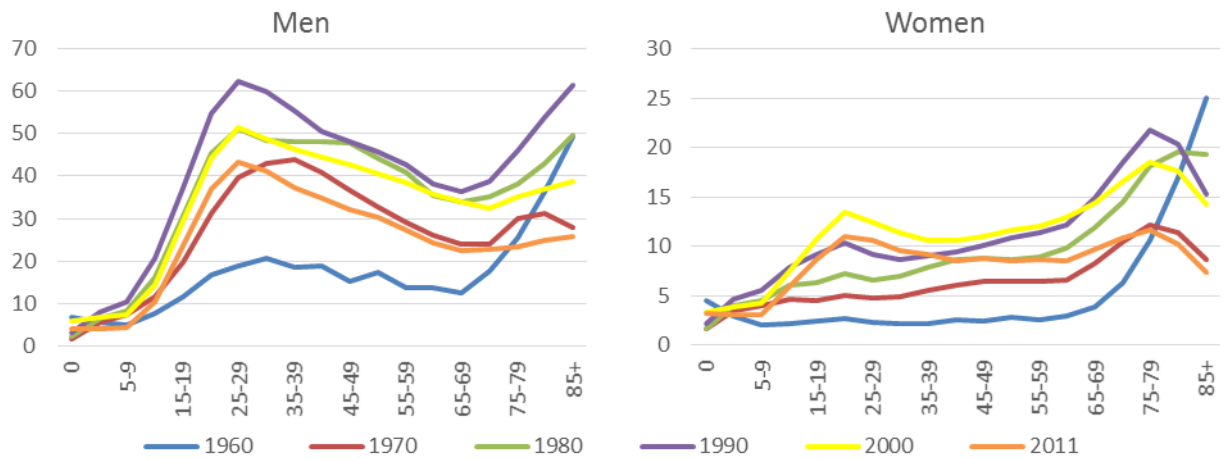


Figure 15. Age profile of mortality from traffic accidents in Russia, by sex, 1960-2012, per 100,000

Source: the author's calculations based on the reconstructed data on mortality from road traffic accidents

Such an age profile of mortality from road traffic accidents is typical not only for Russia but also for most countries. Mortality resulting from traffic accidents would seem to follow some kind of biological or sociological law operating equally everywhere. In most of them, among both men and women, the first peak of road traffic mortality is in the age group 20-24, and the second peak happens in the group aged 85 and over. Russia's lag is characteristic of all age groups. It is especially pronounced among children and among those of working age (Figure 16).

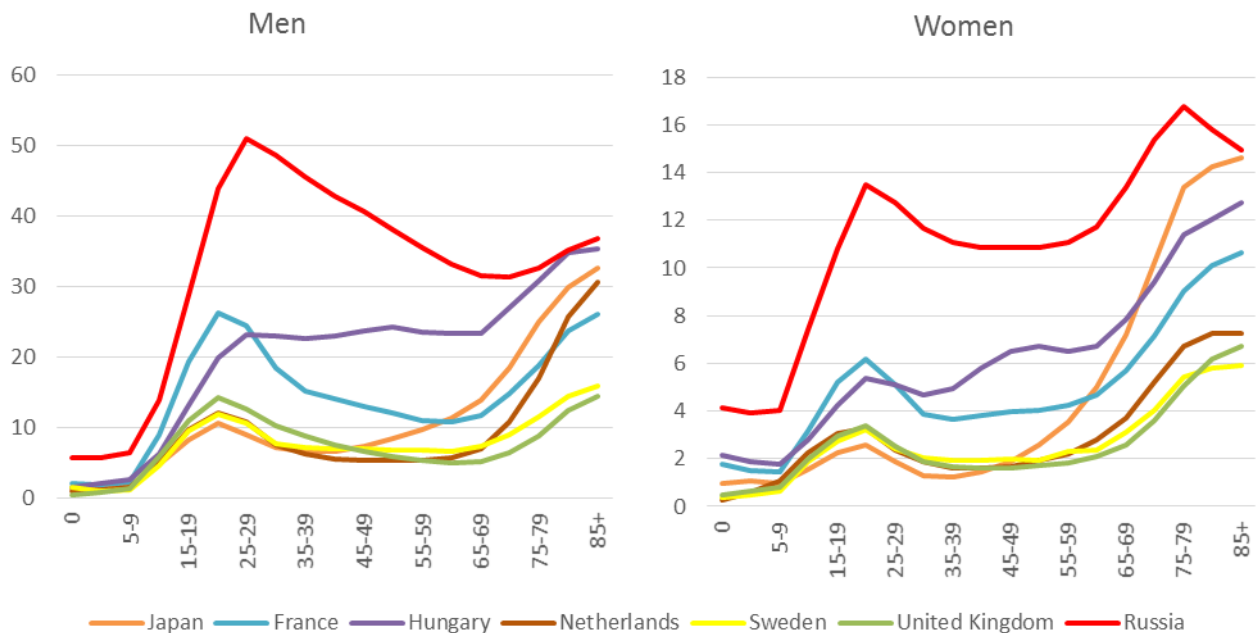


Figure 16. Age profile of mortality from road traffic accidents in Russia and selected countries, average for 2010-2013, deaths per 100,000

Source: the author's calculations based on [WHO Mortality Database] and reconstructed data on mortality from road traffic accidents

In Russia, the dynamics of the age-specific death rate from road traffic accidents can be traced back to 1956. The age distribution of road traffic mortality shows that, throughout the second half of the twentieth century, the main risk group was the working-age population aged 20-40 (Figure 17).

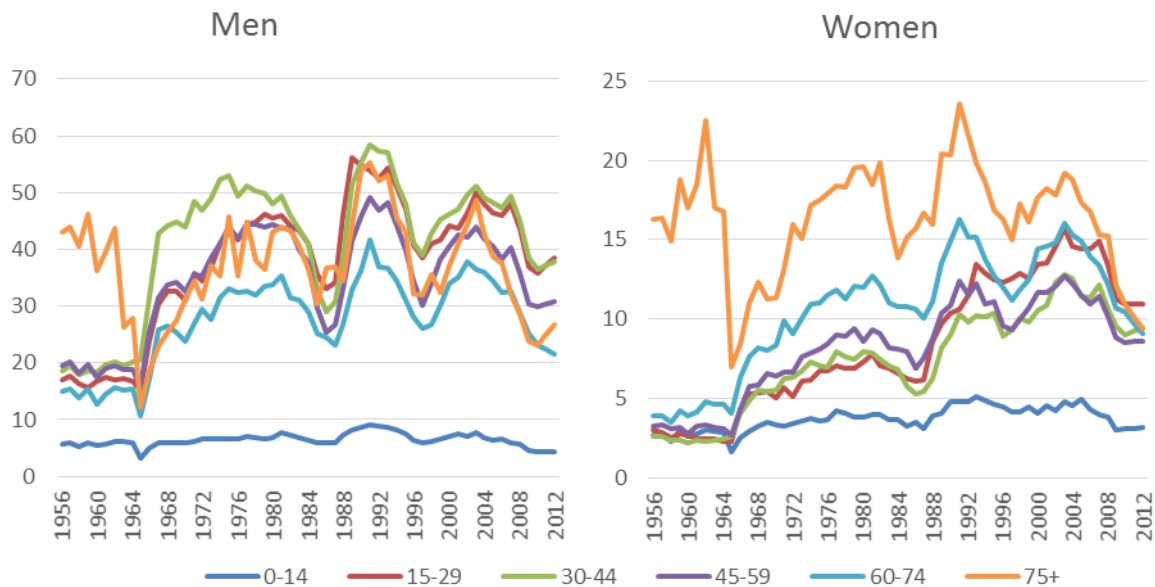


Figure 17. Age-specific death rates from traffic accidents in Russia, 1956-2012, per 100,000

Source: the author's calculations based on [WHO Mortality Database] and reconstructed data on mortality from road traffic accidents

VEHICLE OCCUPANTS AND PEDESTRIANS

In Russia, information on road traffic fatalities by category of road user can be traced to 1991. According to traffic police, until 2009 pedestrians were the main risk group on Russian roads. In the first half of the 1990s, a reduction in mortality from traffic accidents in Russia was characteristic for all groups of road users. From 1998 to 2003, overall mortality from road traffic accidents grew, especially at the expense of vulnerable road users. Since 2004, mortality of pedestrians began to decline again, which cannot be said of the occupants of vehicles. The decline in road traffic mortality observed in the last decade was completely determined by the trends in pedestrian mortality (Figure 18).

Recent trends in pedestrian deaths represent major progress for Russia, but the lag behind advanced countries remains significant. In Russia in 1991, 9 pedestrians per 100,000 perished, while in European countries the level was only 2.8 per 100,000. In 2013, 6 people per 100,000 perished on the roads in Russia, while the number in European countries was 0.9. The gap between Russia and European countries increased during that time from a three-fold to a six-fold difference.

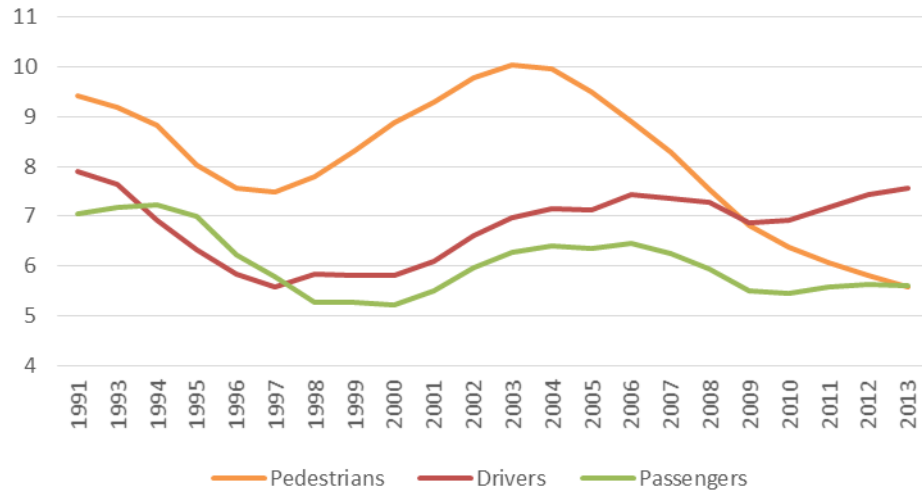


Figure 18. Dynamics of the crude death rates among different road users in Russia, 1991-2013, per 100,000

Source: the author's calculations based on [STSI...]

Mortality among Russian vehicle occupants has not decreased since 1998. Russia's lag behind European countries is widening. In 1991, for every 100,000 people in Russia, 15.5 vehicle occupants perished, while in European countries the number was 8; this constitutes a nearly two-fold gap. In 2013 in Russia, for every 100,000 people 13 vehicle occupants perished, while in European countries the number was 2.7. The gap has grown to a five-fold difference (Figure 19).

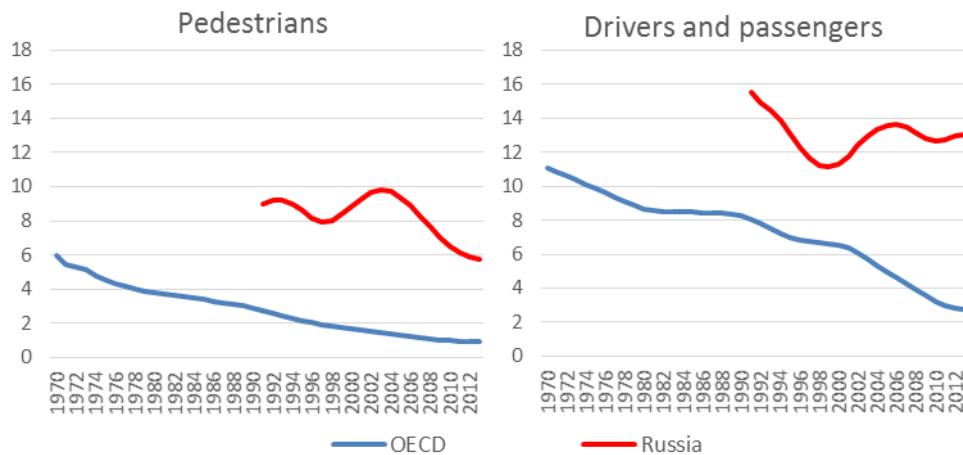
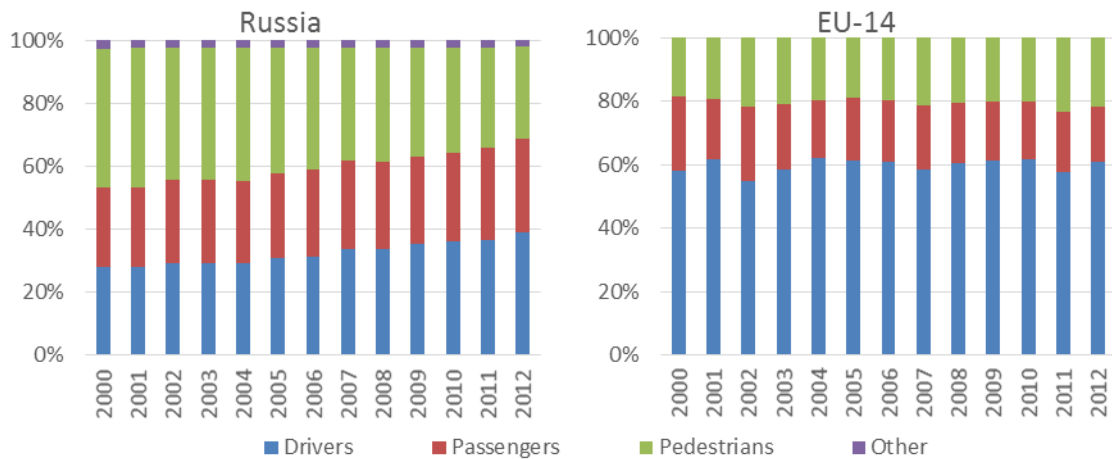


Figure 19. Fatalities of pedestrians, vehicle occupants in OECD (average country indicator) and Russia, 1970-2013, per 100,000

Source: [OECD, STSI...]

In both European and non-European countries with low levels of traffic injuries, vehicle drivers represent the majority of victims currently. The proportion of pedestrians and vehicle occupants among fatalities is small, and the proportion of pedestrians tends to decrease. In Russia, the same tendency is observed, but the proportion of both pedestrians and passengers among road traffic fatalities is much higher than in countries with a lower incidence of traffic injuries.

The success of many European countries with relatively low mortality from road traffic accidents is largely due to the fact that most of them were able to reduce the risk to pedestrians. Though Russia too has embarked on this path, it happened quite late. For a long time, pedestrians were the most vulnerable group of victims. The number of pedestrian victims became less than that of drivers for the first time in 2009, but their share is still very high (Figure 20).



* EU-14: the Czech Republic, Denmark, Germany, Spain, France, Italy, Luxembourg, the Netherlands, Austria, Poland, Portugal, Romania, Finland and the United Kingdom

Figure 20. Structure of road traffic fatalities by category of road users in Russia and the EU-14 countries*, 2000-2012, percent

Source: [European Road Safety Observatory, STSI...]

In the European countries, the greatest reduction in mortality from traffic accidents among pedestrians in the years 1991-2012 was observed in Portugal, Hungary, Poland and Greece. In 2012, pedestrian mortality per 100,000 was lowest in Sweden (0.3), Norway (0.3), the Netherlands (0.4) and Finland (0.5). The highest rates were recorded in Russia (5.8), Poland (3.0), Hungary (1.6) and the Czech Republic (1.6).

As for mortality of protected road users (vehicle occupants) in European countries, from 1991 to 2012 the greatest decrease was shown in such countries as Spain, France, Austria, Belgium and Portugal. The lowest mortality of protected road users in Europe (per 100,000) in 2012 was observed in 2012 in Switzerland (1.3), the UK (1.3), the Netherlands (1.4), Norway (1.4) and Denmark (1.5). The highest rates were recorded in Russia (13), Greece (4.2), Poland (4.2), the Czech Republic (3.5) and Belgium (3.5).

Thus, despite the fact that the structure of road fatalities varies greatly across countries, Russia still maintains absolute leadership in road traffic deaths for all categories of road users (Figure 21).

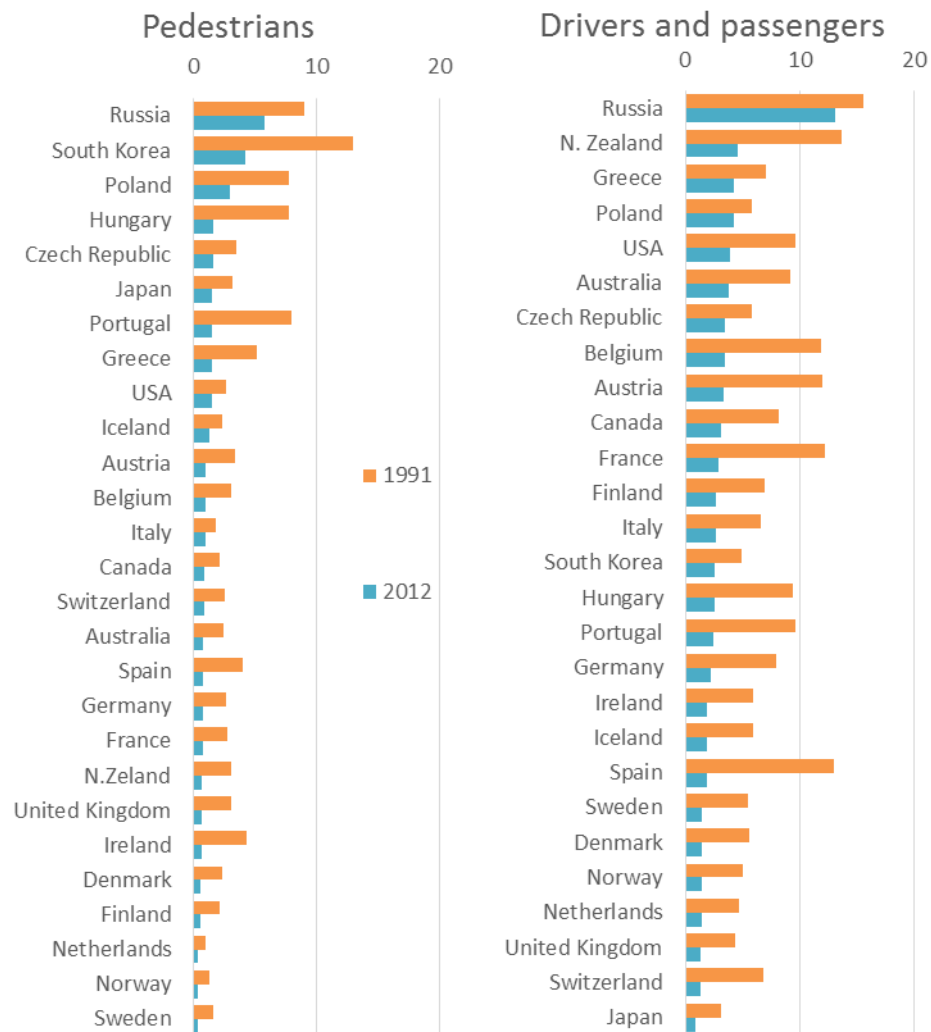


Figure 21. Crude death rate from road traffic accidents for different categories of road users, 1991 and 2012, per 100,000

Source: [International Road Traffic Accident Database; STSI...]

As far as age and sex differentiation is concerned, the following can be observed. Among men, young drivers are most at risk. Mortality among male pedestrians increases with age and peaks in old age. Male passengers have a similar mortality profile to that of drivers, but for every age group except for children, the value of the age rate is lower.

In women, the age structure of mortality for different categories of road users is different. Female pedestrians provide the largest contribution to female road traffic mortality. The profile of the mortality curves for women vehicle occupants is similar to the curve for men, though less pronounced (Figure 22).

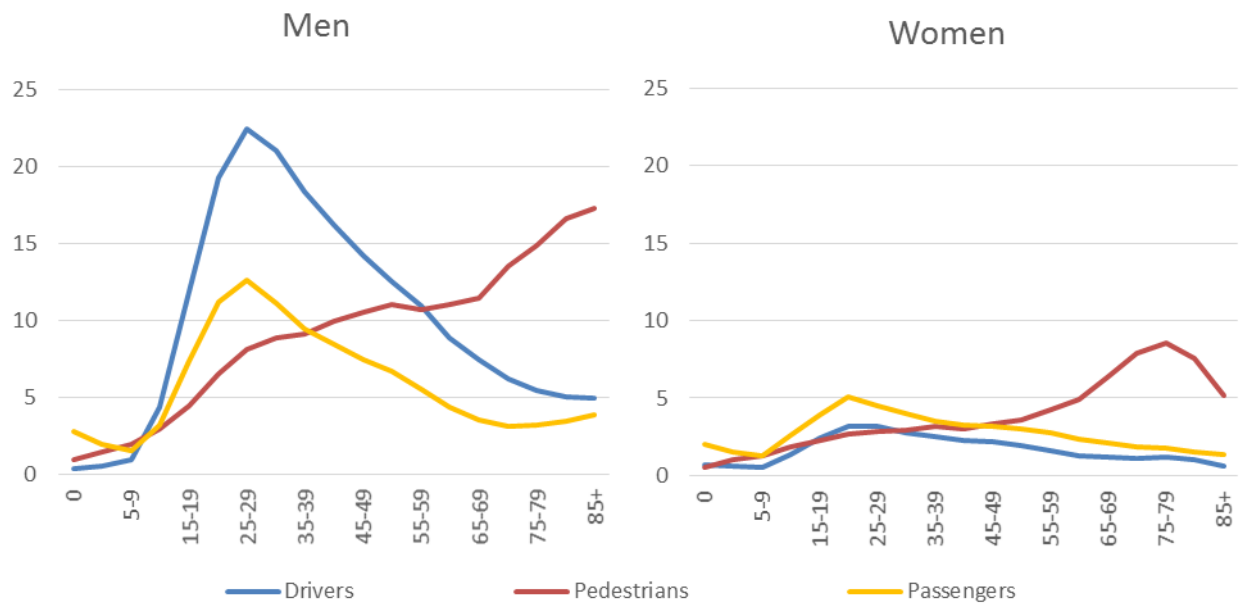


Figure 22. Age-specific death rates from road traffic accidents by category of road users, Russia, 2011, per 100,000

Source: [International Road Traffic Accident Database], Rosstat unpublished data

CONCLUSION

Road traffic accidents are a quite recent cause of death, just a little over 100 years old. But in this century-long history of traffic accidents, three stages of development – “rise, peak and fall” – have been observed. The transition from one stage to another is explained by a combination of factors. Industrialisation and technological progress made possible the birth of the car. Further social development made it a part of public life, with all the ensuing consequences and ideas about the problem. Mass motorisation was accompanied by growing awareness of not only its positive effects, but also its negative ones; views on the problem shifted, and a search for new solutions began. Since Western countries were the pioneers in motorisation, they also had to be the first to find, by trial and error, countermeasures. The results achieved by some countries in reducing deaths from road traffic accidents are stunning. A rate of 3-5 fatalities per 100,000 shows that road traffic accidents are an almost completely avoidable cause of death.

Russia’s level of transport development lags far behind Western countries, and this lag concerns not only the general level of motorisation of the population, but also the level of infrastructural, legal and administrative organisation. There is an underestimation of the importance of research activities in the field of road safety, which has been fundamental in the West.

The lag in the main indicators of transport development, such as the number of fatalities per 100,000, the death toll per 10,000 vehicles, the number of fatalities per mileage and the overall level of motorisation, suggests that Russia’s level of transport development is 40-50 years behind that of Western countries.

The road traffic injury rate in Russia is a highly politicised issue; most people have their own, though not necessarily well-informed, opinion about what can be done to make roads safer. Fragmentary information and its coverage in the media too often interpret individual cases as major transport safety problems requiring urgent action from politicians. But strategic decisions aimed at effective prevention of road traffic injuries should be based on comprehensive and objective information, rather than individual reports from the field.

The authors of the first and second Federal Target Programmes “*Improving global road safety*” implemented in Russia are convinced that they are guided by the best foreign practices. The plan carried out in recent years is essentially focused on fixing the technical deficiencies of public transportation, like separating barriers, the prohibition of mobile phone use while driving, the use of seat belts in the back seat or of child car seats. But the essence of “Western practices” lies not in the technical details, but in the right institutional structures. Transport risks are a function of the quality of institutions in a given country, and depend, above all, on the “total equality of rights, responsibilities and duties of all road users” [Blinkin, Reshetova 2013].

How positive the trends in mortality from traffic accidents in Russia will be in the near future depends on the desire to study and understand the problem. Only in the presence of such a desire will it be possible to develop appropriate, balanced recommendations and solutions in matters of road safety. In the absence of research and regular publications on the problems of road traffic accidents, there remains only the option to adopt random, impulsive decisions.

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