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Data-Driven Strategic Approaches to Road Safety Management: Truth and Lies of Official Statistics

Artur I. Petrov

Department of Road Transport Operation, The Institute of Transport, Industrial University of Tyumen, 625027 Tyumen, Russia; artigpetrov@yandex.ru; Tel.: +7-(912)-079-19-91

Abstract: Approximately 1.25–1.30 million people die annually in road traffic accidents worldwide, and up to 50 million are injured. The UN General Assembly Resolution 74/229 emphasizes the utmost importance of addressing the issue of reducing road traffic accidents. Achieving the ambitious goal of reducing road traffic fatalities and injuries by at least 50% during 2021–2030 is associated with numerous challenges, one of which is ensuring the reliability of official statistics. The accuracy of official data in reflecting the actual situation depends on multiple factors: the quality of the data collection and identification system for road accidents, the responsibility of the officials, and, to a significant extent, the willingness and ability of those in charge to present desired outcomes as reality, thereby distorting the relevant statistics. The issue of inaccurate statistical data and its negative impact on subsequent socio-economic management processes has long been recognized. Different countries address this issue with varying degrees of success. Using data on the characteristics of the road traffic accident rate as an example, the problem of statistical data accuracy in Russia and African countries is considered. A comparison of such countries was chosen to illustrate the real problem of the low credibility of official statistical information available for analysis. Unfortunately, the low quality of statistical information does not allow for drawing accurate conclusions about the actual situation in Russia and African countries, and hence, competently and rationally managing socio-economic processes. This conclusion is based both on the analysis of the results of previous studies and on the original statistical analysis of officially available information.

Keywords: road safety; data on road traffic accidents; analysis; official statistics; reliability and accuracy

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1. Introduction

One of the most serious problems in organizing the management of complex social and socio-technical systems is related to data quality [1]. Goals, criteria, and algorithms of system management are set by the governing body's general understanding of the cause-and-effect relationships and the specifics of the dynamics of system processes. The governing body forms this understanding for itself on the basis of data [2]. That is why statistical agencies exist and operate in all countries. The quality of work of these organizations can be very different. They cannot always provide an acceptable quality of statistical analytics in all countries of the world [3]. The consequence of this is a wide variety of approaches to road safety management—from highly effective in high-quality statistics countries to populist and ineffective in countries whose authorities do not have such statistics. Most often, this problem is typical for developing countries, countries with a relatively low level of socio-economic development [4]. A fairly large proportion of such countries with problematic statistics is localized on the African continent [5]. Russia is perhaps among the countries with partially inaccurate statistics [6,7]. However, the reasons for the inaccuracy of Russian statistics may differ from those in African countries.

This article presents comparative examples of uncertainties about the accuracy of statistical data characterizing the status of the Russian Federation and African countries. These examples concern one of the important aspects of social life—the dynamics of road traffic safety performance. To substantiate the research conclusions about the insufficient objectivity of official statistics on the road traffic accident rate in Russia and African countries, the article also uses the results of the analysis of the related police data and state statistical records of deaths as a result of road traffic injuries.

For a number of countries, the international expert community considers the quality of published data to be unsatisfactory, either due to insufficient organization quality of statistical records or due to the fact that statistical data are deliberately distorted (falsified) [8].

In the latter case, one has to deal with the in situ distortion of data. For example, this happens when regional and municipal authorities are interested in overestimating the population in order to receive larger budget subventions [9]. Another case is the desire of the state leaders to distort statistical data for propaganda purposes [10]. Most often, this results from the desire to demonstrate extraordinary success in the growth of the country's population welfare. As a rule, the unsatisfactory quality of national statistics and falsifications can be detected in a significant (by tens and hundreds of percent) discrepancy between the data of national statistical agencies and the opinions of experts based on world expertise [11].

In this study, the issues in the official statistics accuracy are examined by comparing the characteristics of the road safety data in the Russian Federation (or Russia) and some European and African countries and identifying statistical anomalies.

The goal of the study is to answer questions about the reliability of official statistics in one area of public life—road safety—and the degree of distortion of the actual state of affairs by official statistics. Examples of striving to ensure the correctness of statistical data on road safety in Russia and African countries were chosen as the basic ones. The choice of these countries was based on two main factors. Firstly, African countries have generally been considered outsiders when it comes to the quality of management of socio-public processes. While Russia has made significant efforts in recent years to improve road safety, it has also been treated as an outsider in this regard. The case of Russia shows clear qualitative changes in information processes related to collecting, processing, and presenting data on road accidents. Russian expertise in ensuring the quality of road safety data could become a useful model for African countries in the future.

The studies presented in this article are difficult to categorize unambiguously. On the one hand, a lot of attention is paid to the analysis of the results of previously performed studies. On the other hand, the studied statistics are analyzed using specific examples (Section 6 of the article). In this regard, the genre of this article can still be classified as an "article devoted to the study of the problem" or a "Research article".

2. Design of This Research

While working on this article, the author followed a research plan outlined in Figure 1. The materials are structured in the form of four information blocks.

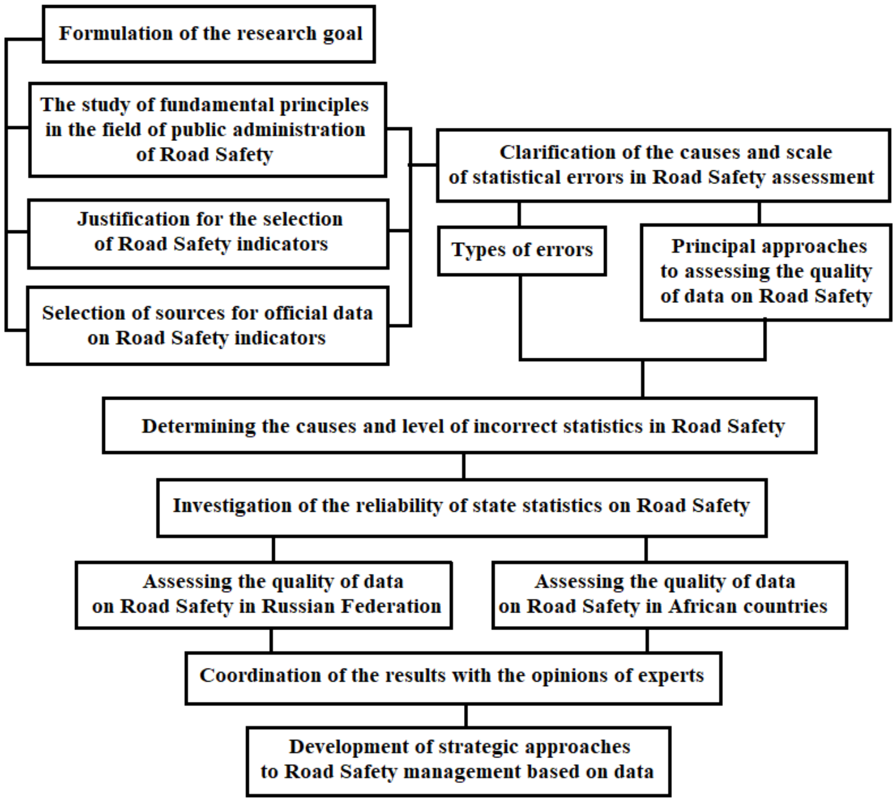


Figure 1. The research scheme.

The first block (Section 3) introduces us to the historical facts and general principles of ensuring road safety (Section 3.1), identification of its characteristics (Section 3.2), and analysis of official data on road safety in different countries of the world (Section 3.3).

The second information block, within Section 4 of this paper, introduces the reader to the concept of statistical error (Section 4.1) and principal approaches to assessing the quality of data on road safety (Section 4.2).

The third information block is the main one and deals with studying the causes and level of incorrect statistics on road traffic accidents (Section 5), investigation of the reliability of state statistics on road safety (Section 6), and expert opinions on the issue of the correctness of statistical data on road safety in different countries of the world (Section 7).

The article concludes (the fourth information block) with an analysis of Russia's best practices in increasing the information availability on road safety data and improving their accuracy (Section 8).

The conclusion summarizes the materials presented in the article and states that the quality of state regulation of socio-economic processes (including road safety) depends not only on goal setting and instruments but also, to a large extent, on the quality of information support.

3. Review of Strategic Approaches to Road Safety Management and Road Safety Indicators

3.1. Strategic Approaches to Road Safety Management

Over 130 years of the active use of cars, humanity has experienced five key stages in the development of views on road safety, the so-called paradigms of road safety [12]. These paradigms replaced each other and had a significant impact on the practical methods used to protect people on the roads. In different countries, the timing of the implementation of road safety concepts varied greatly and mainly depended on the actual level of motorization (Table 1).

Table 1. The evolution of road safety paradigms [12].

Aspects	Road Safety Paradigms				
	First	**Second**	**Third**	**Fourth**	**Fifth**
Level of motorization in the United States, vehicles/ 1000 people (years)	0.1…180 (1900–1925)	181…480 (1925–1965)	481…690 (1965–1980)	690…840 (1980–2010)	>841 (2010–2024)
Level of motorization in European countries, vehicles/ 1000 people (years)	0.1…40 (1900–1935)	41…200 (1935–1970)	201…290 (1970–1985)	291…550 (1985–2010)	>551 (2010–2024)
General characteristics of the data used for accidents analysis	Basic statistics used to answer the question			Multidimensional data	Multidimensional data
	«what»?	«why»?	«how»?		
Basic scientific practices	Law enforcement	Automotive and road engineering disciplines	Theory of traffic management	Sociology of behavior and system analysis	Disciplines related to the use of artificial intelligence

As noted in [13], since the 1950s, in most advanced countries in terms of ensuring road safety, there have been four significant phases of development, which have become progressively more ambitious in terms:

Phase 1 (1950…1969)—Focus on driver interventions (safety management was generally characterized by dispersed, uncoordinated, and insufficiently resourced institutional units performing isolated single functions [14]).

Phase 2 (1970…1989)—Focus on system-wide interventions (these earlier approaches gave way to strategies that recognized the need for a systems approach to intervention [15]).

Phase 3 (1990…1999)—Focus on system-wide interventions, targeted results, and institutional leadership (good-practice countries were using action-focused plans with numerical outcome targets to be achieved with broad packages of system-wide measures based on monitoring and evaluation [16,17]).

Phase 4 (2000…Today)—Focus on system-wide interventions, long-term elimination of deaths and serious injuries, and shared responsibility (today, the growing view is that road safety is a system-wide and shared multi-sectoral responsibility that is becoming increasingly ambitious in terms of its result focus [18]).

However, it should be understood that the evolution of system-wide concepts and relevant road safety practices (Table 1) in different countries of the world proceeds at different speeds and with different degrees of penetration.

The work on improving the collection, analysis, and rechecking of statistical data in different countries has a different status of importance and relevance. Somewhere, as in the Scandinavian countries, this work is recognized as extremely important and has been given a high status. Somewhere, as in African countries, this work is in its infancy. The consequence of this is a very significant difference in the field of ensuring the accuracy of traffic accident data.

3.2. Indicators of Road Safety (RS)

When assessing the accuracy of statistical data, it is necessary to rely not on individual opinions but on official and semi-official data available for analysis.

The approach for comparative studies of the level of the road traffic accident rate generally accepted in the world [15] is based on the use of a number of indicators.

There are a number of official data sources on the RS rate and its indicators in various countries in the world. There are data from the World Health Organization (WHO) [19] and, for example, data from The International Transport Forum (ITF) [20], which are annually published by the Road Safety Annual Report (RSAR). A generally accepted basic approach to identifying the level of RS in the world is to assess the values of the Human Risk *HR* indicator (author—R.J. Smeed [21,22]). To do this, it is necessary to know the statistics of the country's population and the number of citizens killed in road accidents (1) using

$$HR = \frac{N_D}{P},\ deaths\ per\ 100\ \text{thous.people} \quad (1)$$

where

N_D—is the number of deaths in road traffic accidents (RTA);

P—is the population.

This approach is very clear and simple but has a number of significant drawbacks. In particular, it does not take into account the degree of development of the transport system in the country. This disadvantage was intended to offset the Transport Risk *TR* indicator (author—R.J. Smeed [21,22]) (2) using

$$TR = \frac{N_D}{N_{Vh}},\ deaths\ per\ 10\ \text{thous.vehicles} \quad (2)$$

where

N_{Vh}—is the fleet of vehicles.

The indicators *HR* and *TR* can be useful for comparison, but this requires accurate and reliable statistics on the number of deaths in road accidents, the population, and the size of the vehicle fleet in each country. There are many other parameters that characterize the level of traffic accident rate. These include the scale and severity of the consequences of accidents, as well as the socio-economic damage they cause. However, there is a common problem for all these indicators—the problem of accurately determining the number of dead and injured in road accidents. However, the political will and technical capabilities to accurately account for the number of deaths in road accidents vary greatly from country to country.

3.3. Official Data on Road Safety Indicators

The International Transport Forum at the OECD is an intergovernmental organization with 66 member countries. The IRTAD Group validates data for quality before inclusion in the database. So, the Road Safety Annual Report 2023 (RSAR-2023) [23] provides data on the 2022 RS rate only for 35 out of 66 countries—Argentina, Australia, Austria, Belgium, Canada, Chile, Colombia, Costa Rica, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Lithuania, Luxembourg, the Netherlands, New Zealand, Norway, Poland, Portugal, Serbia, Slovenia, Spain, Sweden, Switzerland, the United Kingdom, and the United States. Clearly, the RS rate statistics provided by the other 31 member countries make the ITF doubt their validity.

In 2022, Human Risk (*HR*) was the lowest in Norway (2.1 deaths per 100 thous. people), Sweden (2.1), Iceland (2.4), Japan (2.5), Denmark (2.6), the United Kingdom (2.7), Switzerland (2.8), and Ireland (3.1) [23].

In terms of road safety, African countries are typically in the opposite situation. So, according to the WHO data [19], in 2019, Human Risk *HR* in Zimbabwe exceeded 40 deaths per 100 thous. people. For 17 other African countries (Liberia, Eritrea, Central African Republic, South Sudan, Burundi, Namibia, DR of the Congo, Eswatini, Malawi, Sierra Leone, Chad, Guinea-Bissau, Lesotho, United Republic of Tanzania, Burkina Faso, Mozambique, and Cameroon), this amounted to 30 deaths per 100 thous. people < *HR* < 40 deaths per 100 thous. people.

In 2019...2023, in Russia, the official level of Human Risk *HR* decreased from 11.6 to 9.9 deaths per 100 thous. people [24]. In accordance with the Road Safety Strategy of the Russian Federation, Russia aims to achieve a Human Risk *HR* level = 4.0 deaths per 100,000 people by 2030. This indicates that in the field of road safety, this country is at a stage of catching up with development.

In summary, I note that the range of official Human Risk *HR* values in various countries of the world in recent years (2019...2022) is *HR* = [2.1; 41.2], i.e., it differs by more than 19 times.

Factors such as Transport Risk *TR*, Scale of Traffic Accidents, and Severity of Traffic Accidents are used infrequently in official statistics and in different contexts. Thus, RSAR-2023 [23] provides data on the Transport Risk *TR* value in 29 countries. According to the ITF, in these countries, Transport Risk *TR* varies in the range of *TR* = [0.24; 4.28] measured in "deaths per 10 thous. vehicles". The minimum value of *TR* was recorded in Norway, and the maximum in Colombia.

4. Statistical Errors

4.1. Types of Errors

The errors in accident data can be broadly classified into two types [25]. One is the error in reporting, and the other is the error in recording, as shown in Figure 2.

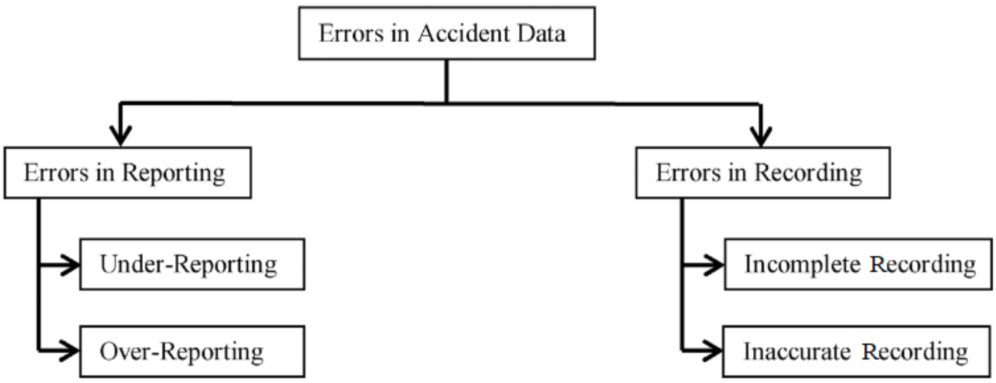


Figure 2. Types of errors in accident data [25].

The error in accident data reporting results in faulty accident rates pertinent to a city, locality, territory, or country. They occur due to the under-reporting or over-reporting of accidents. The error in accident data recording results in ambiguities related to factors responsible for the occurrence of an accident, such as the road, the environment, the driver, the vehicle, the location, the control of the facility where the accident occurred, and the classification of injury severity. They occur due to the incomplete or inaccurate recording of information about the accident.

4.2. Principal Approaches to Assessing the Quality of Data on Road Safety

Perhaps the main issue concerning the quality of road safety data is the different attitudes of the relevant specialists on the accuracy of statistical reporting of road deaths and counting the number of injuries [25,26]. Death toll statistics are more accurate than injury counts [7]. Obviously, this is due to the differentiation in the level of conscious personal responsibility of the relevant specialists in various cases [25].

It is known that under-reporting the road death toll is very likely if only one source of information is used to analyze the results of accidents. This thesis was first voiced in the IRTAD reports [27,28].

Today, in world practice, in order to minimize errors, the use of data matching (record linkage) techniques has become the main approach to assessing the completeness in accounting for fatal and non-fatal outcomes of road traffic accidents based on different sources of information. This approach gained recognition in the late 1980s and early 1990s [29–31]. The use of record linkage of data on the outcomes of road accidents has become widespread since the mid-2000s [32–34] due to the rapid development of computer technologies and software.

According to the World Health Organization report [35], only 25 countries use linked data from different sources as official data on road traffic fatalities, which is a sign of their high accuracy. It is also indicated here [35] that the harmonization of data, in particular on mortality in road accidents, is the most important task facing the statistical departments in almost all countries of the world.

However, even modern information technologies of record linkage do not always make it possible to avoid errors in the statistical accounting for road accident victims.

As noted by A. Pyankova et al. [6]: "Discrepancies in the estimates of the number of deaths according to statistics and the police exist in many countries". They also provide specific data on these discrepancies. In the 39 countries they reviewed (representing Europe, Asia, America, and Oceania), discrepancies in road traffic fatality data reported by the police and statistical organizations range from 1.5% (Sweden) and 1.7% (Denmark) to 35.9% (Bulgaria) and 36.1% (Serbia).

The same authors [6] state that in 23 of the 39 countries reviewed, the number of deaths in road traffic accidents, according to statistics, is higher than that according to the police. Of these, in 11, the excess is more than 10%, and the maximum discrepancies are noted in Portugal and Canada (23.0% and 17.8%, respectively).

Russia belongs to the group of countries where the number of deaths in road accidents, according to statistics, is somewhat lower than the number recorded by the police (a difference of 6.6%).

With regard to the accuracy of statistics on road traffic accidents in African countries, the WHO notes the incompleteness and inaccuracy of these data [8–11].

5. Causes and Level of Incorrect Statistics on Road Traffic Accidents

The International Statistical Classification of Diseases and Related Health Problems, 10th revision (ICD-10) [36] contains 22 classes of causes, among which class XX—external causes of morbidity and mortality (V01–Y98)—is related to the consequences of road traffic accidents. This class contains six blocks of causes of loss of life and health of people, of which the following are related to road accidents: V01–V99 (transport accidents) and W00–X59 (other external causes of accidental injury).

Many researchers [6,37–39] point to the ambiguous interpretation of the meaning of the ICD-10 codes as the main reason for the errors in the statistical reporting of victims of road accidents. This problem is typical for various countries, but especially for those that have limited funding for statistical accounting and analysis [8] and profess an inconsistent state policy towards road safety issues [5].

It is difficult to judge to what extent this thesis applies to Russia and African countries, but let us consider the specifics of state participation in traffic safety management and the statistical accounting for road accidents and their consequences in Russia and a number of African countries.

In Russia, there is a state traffic safety management system with a long history. Back in 1936, in the USSR, of which Russia is today the legal successor, the State Automobile Inspectorate (GAI in Russian) was formed, the main purpose of which was to control all aspects of the functioning of the transport system. Over time, the main functionality of the traffic police has become precisely the provision of road safety. Today, control over the provision of traffic safety is organized at a fairly high-quality level. So, according to the WHO, in general, the policy for ensuring road safety in Russia can be assessed at 8 points on a 10-point scale [40]. At the same time, regarding the compliance of the official statistics [41] on the number of road deaths in Russia in 2021 (14,874) with the modeled data (15,335), the WHO experts assess them as underestimated. However, in general, this decrease cannot be called significant.

As A. Pyankova et al. pointed out in their work [6]: "According to the Russian state statistical institution Rosstat, only those deaths can be considered the result of a road traffic accident for which the following four-digit codes of the Transport accidents block are indicated: V01.1–V04.1, V09.2-3, V10.3-9–V39.3-9, V40.4-9–V79.4-9, and V83.2–V86.2. These codes refer to "transport accidents" and do not include "non-transport accidents" and those "not defined as transport or non-transport accidents", which leads to incomplete reporting of the number of deaths in road accidents in information sources using this approach.

The state statistical reporting of the Russian police about those who died as a result of an accident includes information only about those who died at the scene of an accident or from the consequences of an accident within 30 days. During this period, on the basis of medical notices [42] and reconciliations, changes may be made to the police database regarding the status of the injured person if he or she died in a hospital. If a court case is initiated as a result of an accident, then changes can be made within a year.

As indicated in [38], when comparing the data of the Russian police with the data of the state statistics bodies of Russia, unsatisfactory recording of road accidents as a cause of death in medical death certificates was revealed, including as a result of the use of the so-called "junk codes" ICD-10 (V89, V99, and Y32) and poorly defined causes of death (XVIII class of ICD-10, codes R00–R99).

Perhaps it is important to note that Russia has created and uses the "Multi-level information and analysis system of traffic safety management (RSM MIAS)", the purpose of which is to collect and analyze information about accident-prone areas of the street and road network. It improves the quality of analytical work and, as a result, reduces the proportion of statistical errors.

As for the statistics on road accidents and their consequences in African countries, there is even less confidence in official statistics. According to the WHO [40], to model the number of road traffic deaths N, a negative binomial regression model was used [43,44] (3)

$$lnN = C + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_n X_n + l_n Pop + \varepsilon, \quad (3)$$

where
N—is the total road traffic deaths (of a country per year);
C—is a constant term;
X_i—is a set of explanatory covariates;
Pop—is the population of the country per year;
ε—is the negative binomial error term.

The use of this model in relation to the analysis of road safety in African countries shows that official statistics and estimates for expected deaths in road traffic accidents in African countries do not match (Tables 2 and 3). Table 2 (2016 data) and Table 3 (2021 data) provide a comparison of official reporting data on the number of road accident deaths and similar data modeled using model (3) [40,45]. The analysis of these data reveals a significant discrepancy between the official data and the modeled data.

It should be noted that 10 of the 47 African countries presented in Tables 2 and 3 were selected in alphabetical order. For other African countries, however, there is also a significant difference in the values of indicators "Reported Number of Road Traffic Deaths" and "Modelled Number of Road Traffic Deaths".

The opinion of the WHO experts on the RTA statistics in African countries is clear—the statistics are implausible [46]. This conclusion is a result of significant differences between official statistics on road fatalities and data from experts at WHO, which was modeled based on model (3) [43,44].

The authors of [47] conclude that the governments of African countries are highly interested in information on road safety and note their dissatisfaction with the low quality of this information.

Table 2. Reported and modeled number of road traffic deaths in African countries (2016) [40].

African Country	Road Traffic Death—2016		
	Reported Number of Road Traffic Deaths	Modelled Number of Road Traffic Deaths	
		Point Estimate	95% Confidence Interval
Algeria	No data	No data	No data
Angola	2845	6797	5304–8289
Benin	637	2986	2458–3514
Botswana	450	535	465–606
Burkina Faso	878	5686	499–6872
Burundi	112	3651	2926–4376
Cabo Verde	41	135	118–152
Cameroon	1879	7066	5670–8463
Central African Republic	193	1546	1209–1884
...	...	...	...
Zimbabwe	1721	5601	4602–6599

Note. A sample of data (2016) from 10 African countries was used to demonstrate that the official data does not match the data from the predictive statistical model.

Table 3. Reported and modeled number of road traffic deaths in African countries (2021) [45].

African Country	Road Traffic Death—2021		
	Reported Number of Road Traffic Deaths	Modelled Number of Road Traffic Deaths	
		Point Estimate	95% Confidence Interval
Algeria	3322	8106	7119–9094
Angola	No data	No data	No data
Benin	1124	3225	2645–3804
Botswana	413	426	376–475
Burkina Faso	1272	6137	5032–7242
Burundi	592	1546	1236–1857
Cabo Verde	39	97	86–107
Cameroon	930	2870	2322–3419
Central African Republic	1370	1412	1129–1696
...	...	...	...
Zimbabwe	1902	4782	3874–5691

Note. A sample of data (2021) from 10 African countries was used to demonstrate that the official data does not match the data from the predictive statistical model.

In addition, ref. [47] note that a study conducted in 21 African countries with the help of 29 experts found that road safety data are collected differently in different countries. During the survey, experts from Benin, Botswana, Burkina Faso, Cameroon, D. R. of the Congo, Gambia, Guinea, Kenya, Lesotho, Malawi, Mali, Mauritius, Nigeria, Senegal, Sierra

Leone, South Africa, South Sudan, Swaziland, Tanzania, Togo, and Tunisia were asked the question: "Do you use any national databases/information sources?" with the following answer options:

(a) Road accident databases;
(b) Travel/mobility survey results;
(c) Other exposure databases (e.g., vehicle fleet).

Figure 3 shows the graphical distribution of the answers of these experts.

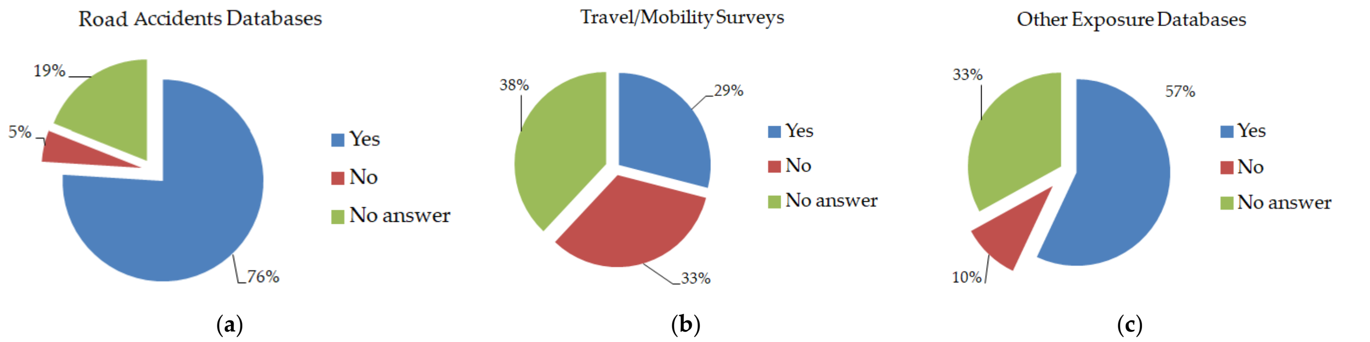


Figure 3. Existence and use of databases/information at national level [47]. Notes: (**a**) No feedback provided from Kenya, South Sudan, Senegal, and Tunisia. (**b**) No feedback provided from Benin, Kenya, Sierra Leone, South Africa, South Sudan, Senegal, Tanzania, and Tunisia. (**c**) No feedback provided from Gambia, Kenya, Sierra Leone, South Sudan, Senegal, Tanzania, and Tunisia.

In the continuation of the study [47], African experts were asked five questions about the existence of road safety controls. The alternative answers were: "Yes", "No", or "I don't know".

Experts from 15 countries responded positively to the question about the existence of a system for collecting, analyzing, and managing data on road accidents and the number of deaths and injuries in the country. No positive response was received to this question from experts from Benin, Burkina Faso, Gambia, Guinea, South Sudan, and Togo.

Experts from eight countries announced the well-established practice of investigating the causes of accidents and identifying the perpetrators (Cameroon, D. R. of the Congo, Lesotho, Malawi, Mali, Nigeria, Senegal, and Togo).

National observatories centralizing data systems for road safety exist in 10 countries (Burkina Faso, Cameroon, D. R. of the Congo, Lesotho, Malawi, Mali, Nigeria, South Africa, Togo, and Tunisia).

A reporting process has been set up to monitor road safety interventions in eight countries (Burkina Faso, Cameroon, D. R. of the Congo, Malawi, Mali, Nigeria, South Africa, and Tunisia).

"Benchmarking" used to monitor progress in the road safety situation is currently used in six countries (Burkina Faso, D. R. of the Congo, Nigeria, Sierra Leone, South Africa, and Tunisia).

Experts from only two countries stated that all five important aspects of ensuring road safety are present in the country: D. R. of the Congo and Nigeria.

So, in summary, let us note that there are two main reasons for incorrect statistics on road traffic accidents in Russia and African countries: the lack of a clear, unambiguous methodology for identifying the causes of death (typical to a greater extent for Russia) and a relatively abstract, vaguely formulated state policy in the field of ensuring road safety, which is reflected in the accuracy of statistics on accidents (typical to a greater extent for African countries).

To evaluate the reliability of government statistics on road traffic accidents, we can compare them with the results of modeling conducted by the World Health Organization (WHO).

For Russia in 2021, this estimate was 3.1%, which is calculated as $[(15{,}335 - 14{,}874)/14{,}874]$. At first glance, this figure seems quite optimistic. But how much does it reflect the real situation?

Estimates of the reliability of government statistics on road accident rates vary widely in African countries. For example, in Botswana, Namibia, and the Central African Republic, the discrepancy between official and model data is only about 3%, while in Chad, the difference can reach very large values (up to 1700%). Seychelles' case cannot be taken seriously (manipulating very small amounts of basic statistical data is nearly impossible).

The calculation of the discrepancy between official and model data on road traffic deaths (2021) is presented in Table 4.

Table 4. Discrepancy between official and model data on road traffic deaths in African countries.

African Country	Road Traffic Deaths—2021		
	Reported Number of Road Traffic Deaths	Estimated Modeled Number of Road Traffic Deaths	Discrepancy Between Official and Model Data, %
Algeria	3322	8106	144
Angola	No data	No data	-
Benin	1124	3225	187
Botswana	413	426	3
Burkina Faso	1272	6137	382
Burundi	592	1546	161
Cabo Verde	39	97	149
Cameroon	930	2870	209
Central African Republic	1370	1412	3
Chad	254	4533	1685
Comoros	32	238	644
Congo	223	488	119
Côte d'Ivoire	1614	5670	251
DR of the Congo	3364	15,615	364
Equatorial Guinea	No data	No data	-
Eritrea	100	640	540
Eswatini	229	295	29
Ethiopia	3971	21,258	435
Gabon	89	293	229
Gambia	200	582	191
Ghana	2890	8494	194
Guinea	682	5061	642
Malawi	1444	4023	179
Guinea-Bissau	100	629	529
Kenya	4579	14,926	226
Lesotho	282	492	74
Liberia	232	794	242
Madagascar	300	6512	2071

Table 4. *Cont.*

African Country	Road Traffic Deaths—2021		
	Reported Number of Road Traffic Deaths	Estimated Modeled Number of Road Traffic Deaths	Discrepancy Between Official and Model Data, %
Mali	736	4429	502
Mauritania	99	438	342
Mauritius	108	126	17
Mozambique	944	6451	583
Namibia	540	557	3
Niger	1152	6278	445
Nigeria	6205	36,722	492
Rwanda	655	1563	139
Sao Tome and Principe	25	26	4
Senegal	877	3502	299
Seychelles	7	7	0
Sierra Leone	336	1165	247
South Africa	12,541	14,528	16
South Sudan	350	2500	614
Togo	680	1961	188
Uganda	No data	No data	-
United Republic of Tanzania	1368	10,052	635
Zambia	2163	3338	54
Zimbabwe	1902	4782	151

These results raise serious doubts about the reliability of official statistics. Obviously, such significant discrepancies in the estimate of the number of deaths in road accidents require additional research to determine the degree of reliability of government statistics.

6. Investigation of the Reliability of State Statistics on Road Safety

6.1. Assessing the Quality of Data on Road Safety in the Russian Federation

The Road Safety Strategy in the Russian Federation for 2018–2024 [48] is the main regulatory document for strategic planning of the road safety policy in Russia. It regulates the achievement of the target Human Risk (*HR*) = 4 *deaths per* 100 thous. people by 2030. This level of road safety has already been achieved (2010. . .2015) in most European countries but is not yet available in Russia. The *HR* for the Russian Federation 2023 = 9.9 *deaths per* 100 thous. people [24], and it is not possible for Russia to achieve a decrease in this indicator by more than 2 times in 7 years (2024. . .2030) [49,50]. In the context of a rigid vertical of state power that has been established in Russia in recent years [51], all elements of the state mechanism are strictly focused on achieving target goals [52]. In this regard, the distortion of state statistics becomes somewhat more likely than in the absence of such strict goal setting. This thesis also applies to the assessment of achievements in the field of road safety. Let us consider the possibilities and causes of such distortions.

Perhaps the main reason for this is an unintentional mistake when the cause of death is established by a paramedic or a doctor whose task was only to ascertain death. This leads to an increase in the number of causes of death, the names of which include "other", "not otherwise specified", and "unspecified" [53–55].

A.E. Ivanova et al. in [56] point to the observed increase in mortality, characteristic of Russia in recent years, from the diagnoses "event of undetermined intent (Y10–Y34)" and "symptoms, signs, and abnormal clinical and laboratory findings, not elsewhere classified (R00–R99)", which may be due to the masking of the causes of death associated with violence [57].

We should not forget about the possible statistical fraud associated with a change in the causes of death of road accident victims. This is especially true for situations of concealing the very fact of death in an accident (for example, in the event of a collision with a pedestrian in deserted places at night). Of course, the disappearance of a person is reported, but the reason for the disappearance is unknown.

In this regard, it is interesting to study the statistics of missing and found people in Russia. According to the Ministry of Internal Affairs of Russia [58], in 2019, 17.2 thousand Russians were missing in Russia. Of these, 15.1 thousand people were found. In 2020, a similar picture was observed at 14.4 and 12.0 thousand people, respectively. Every year, about 2 thousand people per year in Russia go into the category of "missing"; their number is constantly increasing. It is likely that some of them belong to the category of those killed in road accidents (for example, lone pedestrians in a deserted area), whose bodies were taken out of the road accident scene and hidden in the absence of witnesses.

Table 5 shows data [24] on the dynamics of the decrease in the share of pedestrians among those killed in road accidents in Russia in 2015. . .2022. It also presents the statistics of those killed in the "others" category (i.e., unidentified, which may include pedestrians).

Table 5. Official data from the Scientific Centre of the Traffic Police of the Ministry of Internal Affairs of Russia on the share of pedestrians among those killed in road accidents [24].

Category of Those Killed in an RTA	Statistics by Years, % of the Total								
	2015	2016	2017	2018	2019	2020	2021	2022	2023
Pedestrians	31.0	29.0	28.2	27.6	27.3	26.6	26.2	25.0	23.5
Others	2.0	2.0	4.4	3.6	3.7	0.5	0.4	0.5	0.4

A steady decline in the total share of pedestrians and "others" in the number of road deaths in Russia over the past 9 years from 33% to 23.9% may indicate both an increase in the quality of pedestrian protection by improving road transport infrastructure, and the possible distortion of statistics on road accidents by transferring "dead" pedestrians to the "missing" category.

This idea is also confirmed by a comparative study of the statistics of the proportion of pedestrians among those killed in road accidents, conducted for regions with a high population density and a high level of motorization (Central Russia) and, accordingly, for Siberian regions, where the population density is very low, and there may simply not be witnesses of a pedestrian collision.

Table 6 presents such comparative data for the Moscow Oblast and the Krasnodarskii Krai (regions with high population density) and the Republic of Tuva and the Republic of Sakha (Yakutia) (regions with low population density) [24].

Of course, in addition to the deliberate desire to distort the statistics of Russian road accidents on the part of unscrupulous police officers and statistical authorities, there are also objective reasons for such a distortion. And the main one among them is the lack of connection between the data of various bodies that carry out statistical accounting in the Russian Federation.

A. Pyankova et al. [6] conducted an analysis of the related data of the police and the state statistical records on road traffic deaths in Moscow in 2016. The result of their study identified the 80% share of data linkage between the statistics in different departments. The summary of these authors is also interesting: "It can be assumed that one of the reasons for the discrepancy in the number of deaths according to the police and statistics may be that the police reporting system has a 30-day period for reporting road deaths and the statistical agencies do not have this limitation. So, some road deaths may occur and be recorded in the statistics of mortality after the expiration of this period".

Table 6. Official data of the Scientific Centre of the Traffic Police of the Ministry of Internal Affairs of Russia on the share of pedestrians among those killed in road accidents in the different regions of Russia [24].

Russian Region	Population Density, Persons/km^2	Statistics by Years, % Pedestrians of the Total Deaths per RTA		
		2021	2022	2023
Moscow Oblast (Region)	193.8	29.3	31.3	30.6
Krasnodarskii krai	77.1	31.1	26.3	25.9
Republic of Tuva	2.0	21.4	22.2	20.5
Republic of Sakha (Yakutia)	0.3	14.0	14.8	13.5

I.S. Melnikova et al. in [7] noted the discrepancy between the data on the number of road traffic deaths in the Udmurt Republic of the Russian Federation in the reports of the police and the Republican Medical Information and Analytical Centre of the Ministry of Health of the Udmurt Republic. The total data for 5 years (2011...2016) from different departments of Udmurtia on the number of deaths differ by 1.3 times, and on the number of injuries by 1.95 times. An interesting fact is that in the case of deaths, the statistics of the police are significantly higher than the statistics of medical institutions. In the case of injuries, on the contrary, medical statistics significantly exceed police statistics. As a result of this analytical work, the authors of [7] put forward three proposals: "Firstly, at the level of the Ministry of Health, it is necessary to train medical workers and explain to them the basic concepts of coding those killed in road accidents in accordance with ICD-10 [36]. Secondly, we need to develop recommendations for medical workers on reporting the dead and injured in road accidents. And thirdly, a single database on the dead and injured should be created for all ministries involved in the elimination of the consequences of road accidents".

Thus, the data presented in Section 6.1 suggests that there are current opportunities in Russia to improve the accuracy of statistical data on road accidents. Some of these opportunities are being actively implemented, particularly in recent years. You can learn more about them in Section 8.

6.2. Assessing the Quality of Data on Road Safety in African Countries

The Africa Status Report on Road Safety 2020 [59] states that "Ranked as the ninth leading cause of death in the continent, it is estimated that around 296,000 people lose their lives on African roads every year". However, these data are very approximate. According to most world-renowned experts, these data are very underestimated [60–62].

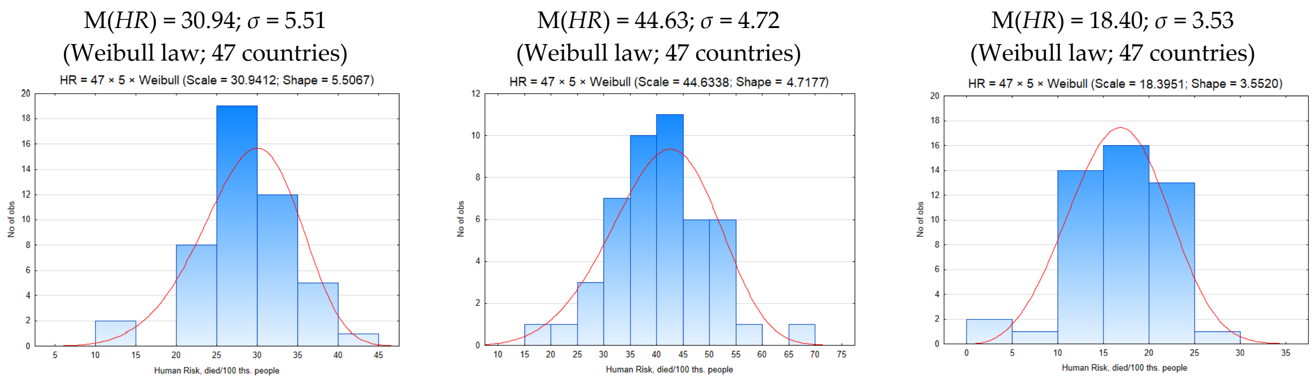
Information sources [60–62] state that it is impossible to find absolutely accurate data on the statistics on road traffic accidents in African countries. The reasons for this are either the lack of national systems for collecting and unifying data on road accidents or attempts to distort the real situation for a variety of reasons.

This is what stops experts from using official statistics when quantifying accidents in African countries. Instead, they use estimated data obtained using specific mathematical models that take into account many direct and indirect factors affecting accidents. According to these models, the road safety situation in African countries is quite problematic [60–62]. Let us use the data on Human Risk *HR* (according to R. Smeed [21,22]) given in [63]. It is specified that these data are estimated (Table 7).

Table 7. Estimated road traffic death rate (per 100,000 people) or Human Risk *HR* (according to R. Smeed [21,22]) in African countries (2019) [63].

Country	Human Risk *HR* (2019), Deaths per 100 Thous. People		
	Female	**All Population**	**Male**
Algeria	13.58	20.90	28.06
Angola	18.16	26.13	34.28
Benin	16.33	26.80	37.30
Botswana	17.82	26.41	35.59
Burkina Faso	21.25	31.02	40.80
Burundi	21.42	35.46	49.74
Cabo Verde	11.07	26.78	42.37
Cameroon	12.47	30.18	47.88
Central African Republic	23.66	37.72	52.02
Chad	21.62	32.43	43.27
Comoros	16.38	26.57	36.58
Congo	21.39	29.70	38.04
Côte d’Ivoire	14.61	24.12	33.45
DR of the Congo	24.35	34.86	45.41
Equatorial Guinea	16.50	26.17	35.70
Eritrea	20.95	37.92	54.81
Eswatini	13.17	33.47	54.59
Ethiopia	16.16	28.16	40.15
Gabon	12.08	23.86	35.21
Gambia	15.64	29.62	43.77
Ghana	11.22	25.67	39.72
Guinea	20.42	29.66	39.56
Guinea-Bissau	29.99	32.23	43.99
Kenya	14.42	28.31	42.37
Lesotho	13.72	31.92	50.64
Liberia	24.93	38.90	52.72
Madagascar	20.04	29.22	38.44
Malawi	15.35	33.40	51.95
Mali	16.35	22.71	29.05
Mauritania	20.51	25.60	30.65
Mauritius	3.49	12.23	21.19
Mozambique	15.02	31.02	45.92
Namibia	15.44	34.81	55.41
Niger	17.37	25.51	33.57
Nigeria	13.11	20.75	28.18
Rwanda	16.14	29.45	43.22
Sao Tome and Principe	12.30	27.90	43.48
Senegal	13.00	23.51	34.56
Seychelles	4.54	11.26	17.64
Sierra Leone	22.98	33.04	43.14
South Africa	9.87	22.22	34.94
South Sudan	24.48	36.73	48.95
Togo	17.84	28.65	39.58
Uganda	13.28	29.39	45.99
United Republic of Tanzania	19.07	31.12	43.20
Zambia	10.31	20.46	30.81
Zimbabwe	16.90	41.22	67.91

The data in Table 6 (2019, All Population) were used to construct histograms of the distribution [64] of Human Risk *HR* values and determine the mathematical expectation of the M(*HR*) distribution. The distribution of *HR* values for the countries on the African continent (2019) is presented in Figure 4.



(**a**) All Population (**b**) Male (**c**) Female

Figure 4. Distribution of the *HR* values for the countries on the African continent.

The distribution of HR values in Figure 3 suggests that the risk of death from road accidents is significantly higher for men. Women, on the other hand, are more cautious and less likely to be involved in accidents.

To create the HR value distribution graphs in Figure 4, we used the StatSoft STATISTICA 10.0.1011 software package.

Table 7 provides data on the top and bottom examples of African countries based on the "Human Risk *HR*" characteristic. It is clear from Figure 3 and Table 7 that Seychelles stands out as a positive example among the relatively problematic African countries in terms of road safety. Zimbabwe, on the contrary, has the worst situation in road safety (Figure 4 and Table 8).

Table 8. Estimated road traffic death rate (per 100,000 people) or Human Risk *HR* (according to R. Smeed [21,22]) in African countries (2019). The Best and Worst Examples.

Estimated Human Risk *HR*, (2019) Deaths per 100 Thous. People			
Data	**The Best Example**	**The Worst Example**	**Mathematical Expectation M(*HR*) for All African Countries**
All Population	Seychelles 11.26	Zimbabwe 41.22	Africa in general 30.94
Male	Seychelles 17.64	Zimbabwe 67.91	Africa in general 44.63
Female	Seychelles 4.54	Zimbabwe 16.90	Africa in general 18.39

Note that the data shown in Figure 4 and in Tables 6 and 7 are not at all identical to the official road accident rate statistics (Table 9) provided by the relevant statistical agencies of African countries [59].

The analysis of the data in Table 9 shows that there are certain problems with the accuracy of these data.

The calculated values of Human Risk *HR* (Table 8) are significantly lower than the WHO data (Table 6) [63]. Thus, for the DR of the Congo, this difference is characterized by a coefficient of $34.86/0.31 \approx 112$. For other African countries (except South Africa), this ratio is lower but also in this range [2.09; 34.37]. The only exception to this rule is South Africa, whose statistics, according to experts, are reliable.

Table 9. Data on road traffic accident rates in some African countries (2019).

Country	Mid-Year Population, Thous. People [65]	Reported Deaths (2019), Deaths [63]	Calculated Value of the Indicator *HR*, Deaths/100 Thous. People	Calculated Value of the Indicator "Severity of an Accident"	Calculated Value of the Indicator "Deaths/Road Accident"
Benin	11,801	810	6.86	15.77	0.255
Burkina Faso	20,321	978	4.81	No data	No data
Cameroon	25,876	1140	4.41	No data	No data
DR Congo	86,791	266	0.31	8.25	1.502
Côte d'Ivoire	25,717	1465	5.70	6.47	0.114
Ethiopia	112,079	5118	4.57	99.73	0.330
Madagascar	26,969	229	0.85	3.93	0.135
Morocco	36,472	3622	9,93	2.37	0.035
Niger	23,311	929	3.99	3.75	0.141
Nigeria	200,964	5483	2.73	40.14	0.152
Senegal	16,296	745	4.57	2.64	0.043
South Africa	58,558	12,503	21.35	No data	No data
Uganda	44,270	3880	8.76	99.74	0.359
Zambia	17,861	1746	9.78	99.26	0.173

The severity of road accidents or the ratio between dead and injured in road accidents for Ethiopia, Uganda, and Zambia $\rightarrow$ 100, which means that only those who died in road accidents are taken into account in the accident rate statistics in these countries, and the wounded and injured are not taken into account.

The calculated values of the "Deaths/Road Accident" indicator vary in an extremely wide range [0.035; 1.502]. This also indicates different approaches to identifying the number of road accidents and deaths in these road accidents implemented in different countries.

In addition, it should be taken into account that African countries use different approaches to registering those killed in road accidents, which differ from the global practice. In most countries of the world, road accident deaths include those deaths when a person dies from the consequences of injuries sustained in road traffic accidents within 30 days [40]. African countries are characterized by a variety of approaches, including those where only the fact of death at the scene of an accident is recorded (Burkina Faso, Guinea, Niger, and Senegal) or death within 24 h after an accident (Madagascar) [59]. For many African countries, the approach to accounting for those killed in traffic accidents is completely unknown [59].

Table 10 shows the data (2019) characterizing the discrepancy between the Estimated Human Risk *HR* and Calculated Human Risk *HR* values in those African countries for which there are data suitable for comparison.

Another indication of the extreme unreliability of data on accidents in African countries can be a comparison of data on Reported Deaths (2016) [59] with data on Estimated Deaths (2016) presented in the WHO 2018 Global Status Report [40] (Table 11).

Earlier in this article (Table 4), data on estimated and reported deaths in 2021 were presented. The analysis shows that during 2016–2021, the problem of very serious discrepancies between the official reported data and estimated data has not lost its significance in any way.

The data in Tables 10 and 11, despite the different formats (taking into account Human Risk *HR* for Table 10 and mortality for Table 11), show a very serious discrepancy between the official reported data and estimated data obtained using mathematical models. That is why the data on road traffic accident rates in most African countries is assigned the 4th class of reliability (Vital Registration System Quality (WHO evaluation)). It is known that the

Values of this classification are defined as follows: (1) a good death registration system, (2) other sources of the cause of death, (3) a country population of less than 150,000, and (4) without eligible death registration data [WHO 2018]. All African countries presented in Tables 6 and 7 (with the exception of South Africa) belong to the 4th class of countries according to the criterion of data reliability. Note that the Estimated Deaths/Reported Deaths ratio largely depends on the economic success of the country. The higher the specific gross domestic product per person (GDP per person) in the country, the higher the value of the Estimated Deaths/Reported Deaths ratio. Obviously, only in economically and socially prosperous countries is statistical accounting for road safety indicators more or less correct.

Table 10. Comparison of Estimated *HR* and Calculated *HR* in some African countries (2019).

Country	Estimated (2019) Human Risk *HR*, Deaths/100 Thous. People [40]	Calculated (2019) Human Risk *HR*, Deaths/100 Thous. People [59]	Ratio (2019) ”Estimated *HR*/Calculated *HR*”
Benin	26.80	6.86	3.91
Burkina Faso	31.02	4.81	6.45
Cameroon	30.18	4.41	6.84
DR Congo	34.86	0.31	112.45
Côte d'Ivoire	24.12	5.70	4.23
Ethiopia	28.16	4.57	6.16
Madagascar	29.22	0.85	34.37
Morocco	No data	9.93	-
Niger	25.51	3.99	6.39
Nigeria	20.75	2.73	7.60
Senegal	23.51	4.57	5.14
South Africa	22.22	21.35	1.04
Uganda	29.39	8.76	3.35
Zambia	20.46	9.78	2.09

Note that only for South Africa, characteristically, the value of the ratio “Estimated *HR*/Calculated *HR*” $\rightarrow$ 1.

Table 11. Comparison of Reported Deaths [59] and Estimated Deaths [40] in some African countries (2016).

Country	Estimated Deaths (2016), Unit [40]	Reported Deaths (2016), Unit [59]	Ratio (2016) ”Estimated Deaths/ Reported Deaths”
Benin	2986	637	4.69
Burkina Faso	5686	878	6.48
Cameroon	7066	1879	3.76
DR Congo	1405	308	4.56
Côte d'Ivoire	5582	991	5.63
Ethiopia	27,326	4352	6.28
Madagascar	7108	340	20.91
Morocco	6917	3785	1.83
Niger	5414	978	5.54
Nigeria	32,076	5053	6.35
Senegal	3609	604	5.98
South Africa	14,507	14,071	1.03
Uganda	12,036	3503	3.44

7. Expert Opinions on the Issue of the Correctness of Statistical Data on Road Safety in Different Countries of the World

Back in 1999 [66], R. Elvik and A.B. Mysen indicated an extremely low level of reporting of very minor injuries. Only 10% of such cases are recorded by the statistical authorities.

The level of reporting of minor injuries is slightly higher at 25%. Serious injuries are reported in 70% of cases. "On average, the reporting level for traffic accident fatalities for the 11 countries with high GDP (Australia, Belgium, Canada, Denmark, Finland, Germany, United Kingdom, Netherlands, Norway, Sweden, United States of America) is about 95 percent" [66]. The situation with the reporting of road accident victims is much worse in countries with a low quality of life. One of the conclusions of the study [66] is formulated as follows: "Reporting level tends to be highest for car occupants and lowest for cyclists. This pattern is consistent across countries. The reporting of single-vehicle bicycle accidents is particularly low—below 10% in all countries studied". Approximately the same conclusion was made by the authors of [26]. Studying the quality of data on reported accidents in seven countries (Belgium, Denmark, Germany, Netherlands, Poland, Spain, and Sweden), they noted that cross-checking the consistency of information exists only in four of these countries (Denmark, Germany, Poland, and Spain). This fact does not fit into the generally accepted idea about the highest quality of the road safety system in the Netherlands and Sweden. As an important problem, they also noted the lack of an unambiguous definition of the concepts of "accident" and "injured in an accident". They consider the low reporting of accidents involving cyclists to be an even bigger problem [26].

Y. Chung and I. Chang [37] conducted studies using recorders (black boxes) in order to assess the accuracy of accident data. First of all, they were interested in the actual speed of vehicles at the time of the accident. However, the necessary collection of statistics on road accidents made it possible to assess the quality of the work of the police who recorded the corresponding road accidents. Their expert opinion regarding the accuracy of the police records of accidents and their consequences can be expressed by the following phrase: "an interesting result was found in the accuracy of police-recorded accident data with respect to crash injury severity: increasing the level of injury severity resulted in more accurate recording of crash speed. It could be due to the fact that speeding is one of the major causes of accidents, and a citation can be issued or an arrest can be made".

A. Ahmed et al. [25] also noted a very significant level of error in official statistics illustrating road accidents: "Among high-income countries, the extent of error in reporting slight, severe, non-fatal and fatal injury accidents varied between 39–82%, 16–52%, 12–84%, and 0–31%, respectively. For middle-income countries, the error for the same categories varied between 93–98%, 32.5–96%, 34–99% and 0.5–89.5%, respectively. The only four studies available for low-income countries showed that the error in reporting non-fatal and fatal accidents varied between 69–80% and 0–61%, respectively".

L.M.M.M. Paixão et al. in [67] analyzed deaths in Belo Horizonte, Brazil, by combining two government databases and found a 24% underreporting of deaths.

A. Watson et al. [68] conducted a large-scale (n = 19,041) analytical work to assess the correspondence between data from various Australian regional databases on the number of road traffic injuries. In particular, they studied the correspondence between the data from the Queensland Road Crash Database (QRCD) police data, the Queensland Hospital Admitted Patients Data Collection (QHAPDC), the Emergency Department Information System (EDIS), and the Queensland Injury Surveillance Unit (QISU). The aim of the study was to identify the effect of the age of RTA victims on discordance rates. The results of this study are presented in Figure 5.

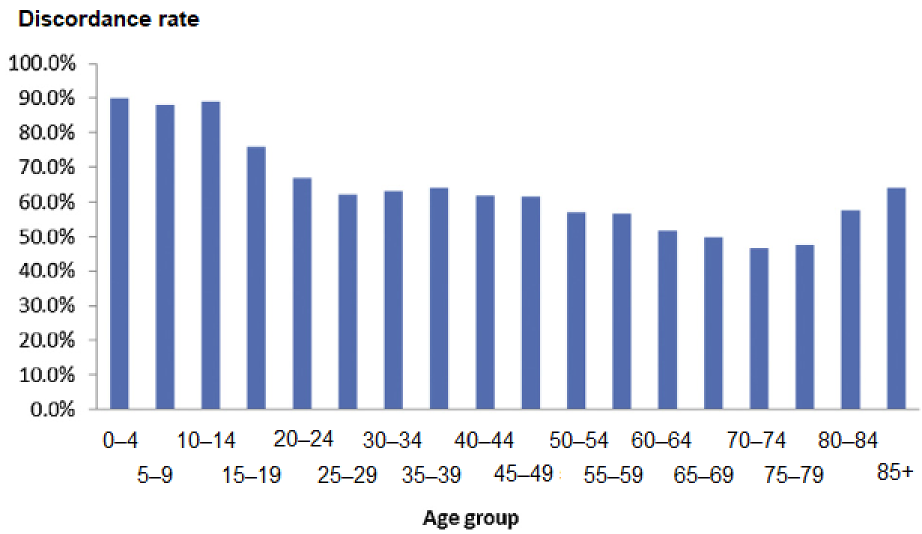


Figure 5. Discordance rates between police data (QRCD) and road crash-coded hospital data cases for different age groups [68].

The consistency of the discordance rate was examined for QRCD cases and the combined hospital data (i.e., QHAPDC, EDIS, and QISU). There was a statistically significant difference in the discordance rate based on road users for road crash-coded hospital data cases [$\chi^2(4) = 5686.25$, $p < 0.001$, $\phi_c = 0.52$]. Specifically, motorcyclists and cyclists had a higher-than-expected discordance rate.

There was also a statistically significant difference in discordance rate based on age for road crash-coded hospital data cases[$\chi^2(18) = 1800.32$, $p < 0.001$, $\phi_c = 0.25$]. Specifically, those aged 19 years and younger had a higher-than-expected discordance rate [68].

P. Giorgi Rossi et al. [69] indicated in their study that "our surveillance system reported 600% more injuries and 21% more fatalities than official statistics based on police reports". Further, they indicated that "the underreporting depends on the type of road user (largest for cyclists) and on severity".

G.M. O'Reilly et al. [39] evaluated the approaches used to record car injuries in medical institutions in 15 different countries and concluded that there is no unification in identifying both the severity of injuries and in determining the causes of these injuries.

S. Ma et al. [70] informed that in China, there are four databases on road accidents: the Ministry of Health-Vital Registration (MOH-VR) System; Chinese CDC-Disease Surveillance Points (DSP); Chinese CDC-National Injury Surveillance System (NISS); and Police-reported data. The data consistency of these databases is quite low: "the rates of traffic death reported by MOH-VR and DSP are much higher than that obtained from the police".

R.Y. Medina et al. [71] stated: "studies that have collected and compared information from the health sector and the police have revealed differences in mortality, morbidity, and severity of injury by data source".

Summarizing the above examples, we can state that the issue of accuracy and reliability of statistical data in the road safety sphere is, to one degree or another, relevant for all countries of the world, regardless of the level of socio-economic development, the quality of public institutions, and the level of self-awareness of the relevant specialists. Of course, in some countries, the situation with the recording of road traffic injuries and deaths looks much better. And yet, the problem remains relevant for almost all countries.

8. Data-Driven Strategic Approaches to Road Safety Management: How Can Significant Progress Be Made in Improving Road Safety? The Case of Russia

Despite the challenges encountered in collecting and analyzing road safety data, efforts have been made in recent years to improve the accuracy of information on road accidents in Russia. To this end, special institutional structures have been created, such as the State Road Safety Inspectorate of the Russian Federation [24], which has been given the relevant powers. Secondly, since 2015, the Scientific Centre for Road Safety has been engaged in the identification of all traffic accidents with victims, their primary analysis, and verification of the accuracy of the data. Thirdly, this work is carried out openly so that the public and interested persons, including direct participants in such accidents, can verify and correct the information.

This is accomplished by openly sharing information with the public on the website of the Russian State Automobile Inspection (RSAI). Figures 6–8 show screenshots of various modes of operation of the Russian internet site "Indicators of road safety" [72].

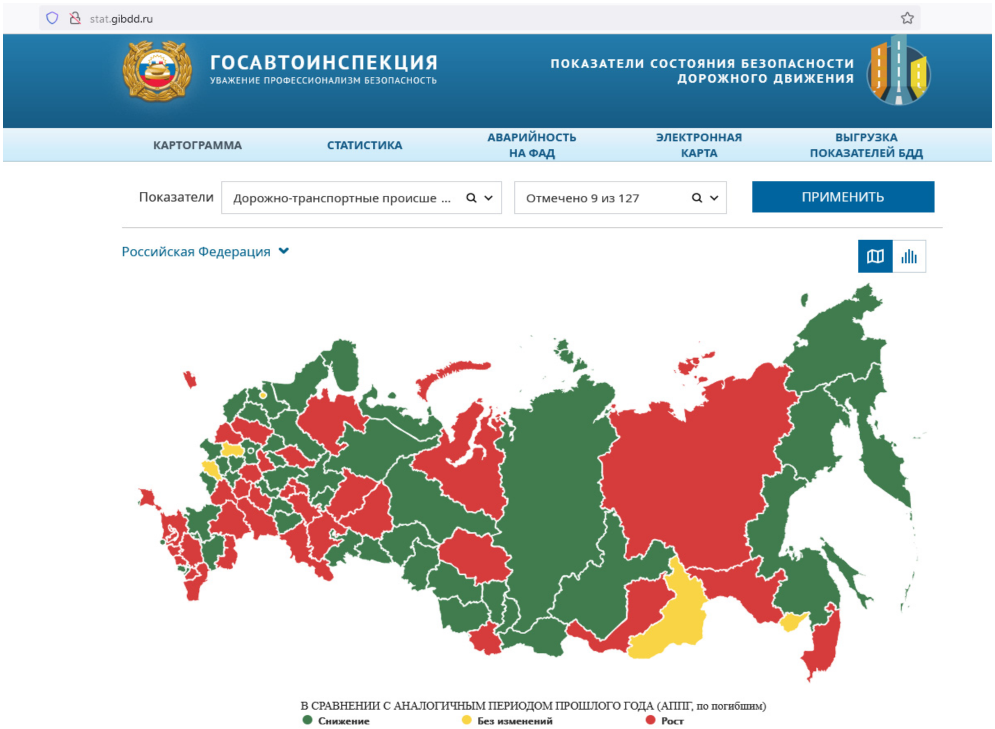
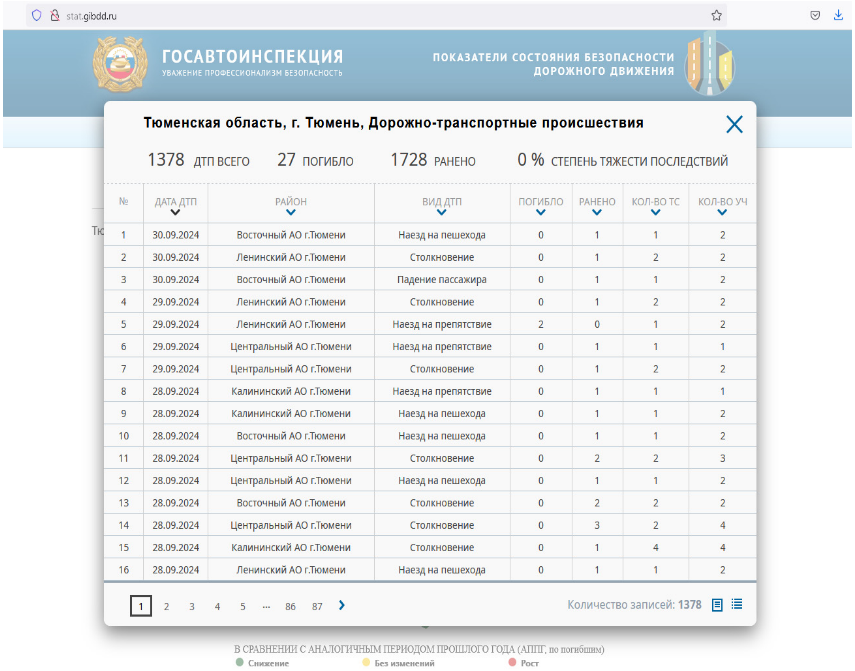


Figure 6. The homepage of the website of the Russian State Automobile Inspection (in Russian), which provides information about road accidents [72]. Note. The red color shows the regions of the Russian Federation characterized by a negative trend in the number of road accidents (2024/2023). The green color identifies the regions of the country where road safety improved in 2024 compared to 2023.

It is important to note that this work produces tangible results. This is evident when comparing official statistics on the number of road accident deaths in Russia with those produced by WHO modeling. While in 2016 the difference between the official data and the WHO estimates was 27.8%, it decreased to 3.1% in 2021. During the period from 2016 to 2021, Russia saw a positive trend in road safety. This was the result of several important changes, including the creation of a dedicated management body and the establishment of a productive dialogue between society and government agencies responsible for monitoring road safety. On the other hand, it would be incorrect to overstate the positive outcomes of this work. As noted in Section 6.1, despite the overall goal of the Russian government to improve the accuracy of traffic accident statistics, this effort is carried out to varying degrees of effectiveness in different regions of the country. In remote areas of the country with low population density, it may be more difficult to ensure the accuracy of statistical data due to potential shortcomings or miscalculations.



№	ДАТА ДТП	РАЙОН	ВИД ДТП	ПОГИБЛО	РАНЕНО	КОЛ-ВО ТС	КОЛ-ВО УЧ
1	30.09.2024	Восточный АО г.Тюмени	Наезд на пешехода	0	1	1	2
2	30.09.2024	Ленинский АО г.Тюмени	Столкновение	0	1	2	2
3	30.09.2024	Восточный АО г.Тюмени	Падение пассажира	0	1	1	2
4	29.09.2024	Ленинский АО г.Тюмени	Столкновение	0	1	2	2
5	29.09.2024	Ленинский АО г.Тюмени	Наезд на препятствие	2	0	1	2
6	29.09.2024	Центральный АО г.Тюмени	Наезд на препятствие	0	1	1	1
7	29.09.2024	Центральный АО г.Тюмени	Столкновение	0	1	2	2
8	28.09.2024	Калининский АО г.Тюмени	Наезд на препятствие	0	1	1	1
9	28.09.2024	Калининский АО г.Тюмени	Наезд на пешехода	0	1	1	2
10	28.09.2024	Восточный АО г.Тюмени	Наезд на пешехода	0	1	1	2
11	28.09.2024	Центральный АО г.Тюмени	Столкновение	0	2	2	3
12	28.09.2024	Центральный АО г.Тюмени	Наезд на пешехода	0	1	1	2
13	28.09.2024	Восточный АО г.Тюмени	Столкновение	0	2	2	2
14	28.09.2024	Центральный АО г.Тюмени	Столкновение	0	3	2	4
15	28.09.2024	Калининский АО г.Тюмени	Столкновение	0	1	4	4
16	28.09.2024	Ленинский АО г.Тюмени	Наезд на пешехода	0	1	1	2

Figure 7. The page of the Russian State Automobile Inspection website (in Russian) that presents all the traffic accidents in which people were injured in Tyumen City in 2024 [72]. Note. Data from the statistics on road accidents in Tyumen City for 9 months of 2024. Not only are general statistics available (1378 road accidents/27 people died/1728 people were injured), but also details of the circumstances of these cases.

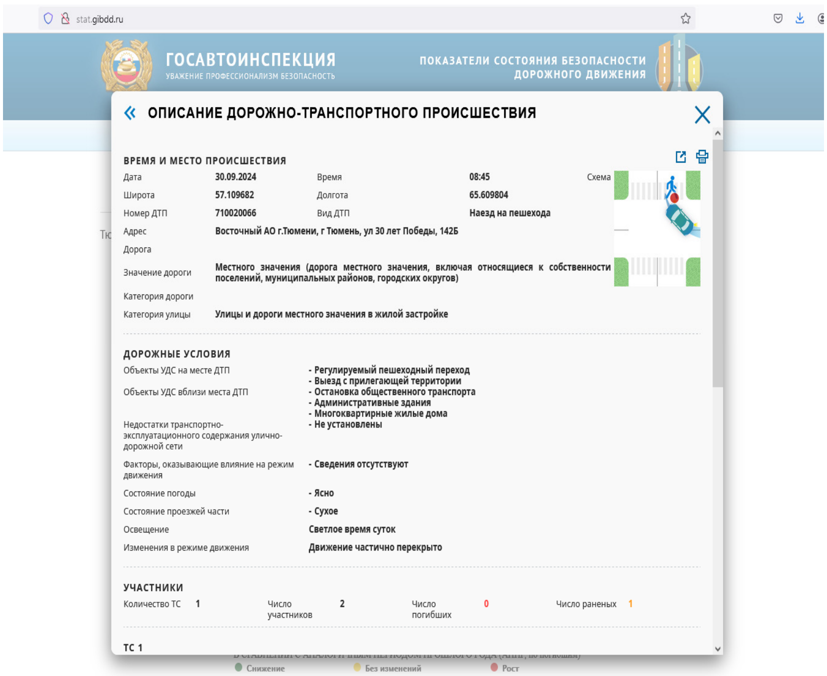


Figure 8. The page of the Russian State Automobile Inspection website (in Russian) that contains information about a traffic accident that occurred on 30 September 2024, in Tyumen City at 08:45 local time. The coordinates of the accident site are 57.1 degrees north latitude and 65.6 degrees east longitude [72]. Note. A detailed description of a specific pedestrian collision (case No. 1 in the base Figure 7). The date of the road accident is presented (30 September 2024), and the location of the road accident, road conditions, participants in the road accident, and consequences of the incident).

9. Conclusions

The quality of the management of socio-economic processes depends on the quality of the information support [1]. Without reliable data on the actual situation in a particular area of life, one can not only make mistakes in assessing the current situation but also incorrectly set goals in the processes of managing socio-economic processes. That is why all countries have Departments of Statistics as separate divisions of their government. Their goal is to collect and correctly analyze data characterizing the situation in certain areas of life. It is only on the basis of reliable data and their rigorous analysis that it is possible to competently, effectively, and efficiently build a system of priorities in the management of socio-economic life.

The examples considered in this article show that there are certain problems with the collection and analysis of statistical data in various countries of the world. Obviously, this has an extremely negative impact on processes of socio-economic development. In this regard, the author would like to once again emphasize the importance of the accuracy of statistical data. The comparative examples of assessing the road safety data presented in the article illustrate well the relevance of this topic for most countries of the world.

The emphasis on the analysis of the accuracy of road safety data in Russia and African countries, made in this article, is intended to illustrate the particular importance of this issue for developing countries, for which road safety is a significant but not a priority issue.

In conclusion, I would like to emphasize that in recent years in Russia (2015–2024), a lot of work has been accomplished to improve the reliability of statistical data on road safety reporting. Perhaps the most significant factor in this regard is the increased transparency of road accident statistics for society and the opportunity for feedback in order to correct any errors or inaccuracies in these statistics. Obviously, African countries will one day follow the same path as Russia is already taking, and the accuracy of their statistical data will improve as well.

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