Road Safety Status Monitoring and Evaluation

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\textbf{Abstract.} Prevention of road traffic injuries requires a strong awareness of the situation on roads. The main sources of information on road safety are state statistics, sociological and observational studies. Observational studies or monitoring are among the most effective ways of obtaining information. The implementation of the RS-10 international project in Russia demonstrated the importance of all sources of information working jointly, which made it possible to develop effective actions on reducing road traffic injuries, to implement the actions and to evaluate the results.

1. Introduction

“Road traffic injuries can be prevented. Governments need to take action to address road safety in a holistic manner. … Effective interventions include … setting and enforcing laws relating to key risks, and raising public awareness.” [1].

The effectiveness of actions to address the safety of roads is ensured by the quality of information obtained from various sources, monitoring being the most important of them.

“Monitoring road safety is systematic data collection and processing which can be used to improve decision-making and, indirectly, to inform the public or, directly, serve as a feedback mechanism during the project implementation process, programme evaluation or policy development.

Monitoring has one or more of the three organizational functions:

\begin{itemize}
  \item to identify the status of critical or changing phenomena (in the present case, road users’ behaviour) in reference to which a course of action will be defined;
  \item to shape the relationship with the object of study, providing feedback on successes and failures of previous specific policies or programmes; and
  \item to establish conformity to standards and regulations.
\end{itemize}

The objective of monitoring road users’ behaviour is to understand their actual behaviour (or attitude) in reference to a specific RTI risk factor, for example to seat-belt and child-restraint use or compliance with speed limits.” [2].

Monitoring makes it possible to obtain quantitative data providing a realistic evaluation of the way the investigated risk factor influences the road safety level and to make a decision on the necessity of various measures to improve road safety.

The monitoring of road users’ level of attitude to a particular road safety risk factor with regard to injuries and deaths is performed according to the following evaluation [2]:
- what people say – roadside and target audience surveys: awareness, behavior (attitude), implementation (subjective evaluation);
- what people do – observational studies: e.g. on speeding and seat-belt use (objective evaluation);
- analysis of statistics in regard to road accidents – changes in road traffic crashes, injuries and deaths reported by traffic police and hospitals.

2. Forms of monitoring and types of studies
The most complete quantitative data for understanding the problem are based on observations (observational studies). The qualitative data (behavior causes) can be obtained only through sociological studies (e.g. of focus groups) and roadside interviews.

How to organize the studies – methods and organizational models of data collection and analysis
It is most rational and effective to use the resources of regional universities, with the following possibilities:

- large-scale studies;
- regular monitoring of the road safety level, in particular by specific types of traffic rules violations by road users;
- survey of places with a high concentration of road accidents;
- analyzing the data of any complexity.

The approximate order of conducting quantitative studies is as follows. First, the goal, objectives and scope of the studies are defined. Further, a method of studies is developed which is to guarantee the required quality of studies depending on the goals and objectives.

2.1. The results of the studies and their use in decision-making
The quantitative data obtained in studying a particular risk factor are a basis for decision-making on further work to improve road safety. Traditionally, there are two ways to lower the risk factor. The first one is to enhance the supervisory activities on this risk factor. As a rule, it is of a temporary character. The second one is the awareness of road users and the formation of public opinion aimed at stirring up intolerance towards a specific risk factor. The second way involves sociological studies and the development of social and marketing tools to influence road users. The joint use of the two directions yields the greatest effect.

2.2. Research within the framework of the RS-10 Project
In 2010, the international project “Road safety in 10 countries (RS-10)” [2,3,4,5] was launched in Russia. Lipetsk State Technical University initially joined the Project as a partner of the Johns Hopkins University for studies including monitoring and interviews aimed at evaluating the attitude of residents of the Lipetsk region to seat-belt and child-restraint use. In the spring of 2011, the Ivanovo State Architectural and Construction University joined the monitoring.

In 2011, both universities began the studies which included the monitoring of compliance with speed limits and the interviews aimed at evaluating the attitude of residents of the Lipetsk and Ivanovo regions to speeding.

Monitoring was conducted in 6 districts of the Lipetsk region and in 7 districts of the Ivanovo region in cities, on regional roads and on local roads.

Following the agreement with the Johns Hopkins University, in each round, observations were carried out at 18 sites in the Lipetsk region and at 21 sites in the Ivanovo region for 7 days.

During the study period, 17 rounds of observational studies on seat-belt and child-restraint use, 14 rounds of observational studies on daytime speeding and 1 round on nighttime speeding were carried...
out in the Lipetsk Region. In the Ivanovo Region, there were 15 rounds of observational studies on seat-belt and child-restraint use and 12 rounds of observational studies on speeding. [2].

The total amount of studies in each round was equal to at least 30,000 observations of road users (drivers, passengers, children) when monitoring seat-belt and child-restraint use and at least 30,000 cars while monitoring the speed rate.

The interviews the aim of which was to evaluate the attitude of residents to seat-belts and child-restraints and to speeding was conducted 8 and 7 times respectively in the Lipetsk region and 9 and 6 times in the Ivanovo region. In total, at least 600 interviews were conducted in each round on seat-belt and child-restraint use and on complying with the speed limit [2].

Currently, six key risk factors are commonly recognized as related to injury prevention in road accidents and can be used for monitoring and evaluation studies [6]:

- speeding;
- drunk driving;
- motorcycle helmets;
- seat-belts;
- child-restraints;
- distracted driving (using a phone while driving)

An additional risk factor to be considered is that connected with pedestrians.

The best practices in working with the main risk factors of road traffic injuries for decision-makers are described in specialized manuals [7,8,9,10,11].

The road safety status is monitored and evaluated, primarily, according to current data on injuries and, secondly, using the results of law enforcement practices.

There are 3 general approaches to monitoring the road safety status:
1. State statistics.
2. Sociological studies.
3. Observational studies.

**State statistics** are collected, as a rule, by the Ministries of Internal Affairs and Public Health.

The ministries collect current data on the number of road accidents, road injuries and deaths. These data are the main sources for evaluating the safety level status; at the same time, they do not fully reflect the quality of the measures being taken, e.g. the implementation of the Federal Target Program, since the results may come later due to inertia reasons.

The Ministry of Internal Affairs also collects data on the number of violations of traffic rules identified. These data make it possible to evaluate the law enforcement activities in the bodies subordinate to the Ministry of Internal Affairs, but, as a rule, do not fully reflect the level of road users’ legal awareness.

**Sociological studies** make it possible to both evaluate road users’ level of legal awareness and to solve a number of important related tasks dealing with evaluating various activities and campaigns aimed at road users following road safety standards.

Sociological studies imply:

- full-scale, representative studies before and after the campaign;
- analysis and evaluation of the situation before the start of the campaign or event (for what);
identification of the intended target audience (for whom);

quantitative and qualitative studies to clarify the characteristics of the target audience;

valuation and analysis of the campaign or event effectiveness via focus groups;

development of recommendations for improving the effectiveness of events or campaigns with their test on focus groups.

Sociological studies make it possible to:

evaluate current behavior;

determine the attitude of the social environment;

determine the reach to the audience;

determine the motives / barriers that determine behavior;

determine the most effective communication channels;

valuate the behavior change after the end of the campaign or event.

The main advantage of using sociological studies is the possibility of evaluating both separate events and the whole program on the analysis of changes in road users’ behavior. Its disadvantage is the probability of insincere answers from survey participants, which is not high because surveys and work with the target audience imply anonymity.

Observational studies, which provide the most objective evaluation of the situation, are relatively simple and inexpensive. These studies are recommended in the Global Status Report On Road Safety (2009) for comprehensive monitoring [12].

The possibilities of using a particular type of studies according to the main risk factors are given in Table 1.

Such risk factors as speeding and drunk driving must be spoken about separately.

In order to determine the level of compliance with the speed limit via observational studies, additional equipment is required, and, therefore, additional costs. However, the speed rate studies in the pilot regions of the Russian Federation within the RS-10 project made it possible to evaluate for the first time the compliance with the speed limit on different roads [13,14].

| RISK FACTOR                        | *   | **  | *** |
|------------------------------------|-----|-----|-----|
| Recommended by WHO                 |     |     |     |
| 1 Speeding                         |     |     |     |
| 2 Drunk driving                    |     |     |     |
| 3 Motorcycle helmets               |     |     |     |
| 4 Seat-belts                       |     |     |     |
| 5 Child-restraints                 |     |     |     |
| 6 Distracted driving (using a phone while driving) | | | |
| Additional                         |     |     |     |
| 7 Pedestrian traffic               |     |     |     |

Notes: * State statistics; ** Sociological studies; *** Observational studies.

1When there is special equipment.
The level of law enforcement against speeding can indirectly be estimated according to the number of devices controlling the speed rate and its growth rate. The content of the legislation is an important element, too. For example, in Russia there are two concepts – permissible speed and maximum legal speed, which is not fined. The difference between them is 20 km/h. Besides, Russia has not yet banned radar detectors that warn drivers of speed control, thus allowing speeding at uncontrolled sites. All this significantly reduces the effect of law enforcement.

The greatest challenge is to evaluate the level of enforcing legislation against drunk driving. Among the available methods are state statistics and sociological studies. In state statistics, there are two kinds of data on drunk driving: the number of road accidents caused by drunk drivers and the number of drunk drivers identified during road police raids, the data on which are represented as absolute values.

The data obtained during the raids make it possible to evaluate the level of enforcing legislation against drunk driving, for which the following formula is proposed

\[ P = \frac{N_D}{N_T} \times 100 \]

where \( P \) is the law enforcement level expressed in % and which is representing the proportion of drunk drivers;
\( N_D \) is the number of drunk drivers;
\( N_T \) is the total number of drivers stopped during the raid.

3. Conclusions
The quantitative data obtained in studying a particular risk factor can be the basis for decision-making on further work to improve road safety. Traditionally, there are two ways to lower the risk factor. The first one is to enhance the supervisory activities on this risk factor. As a rule, it is of a temporary character. The second one is the awareness of road users and the formation of public opinion aimed at stirring up intolerance towards a specific risk factor. The second way involves sociological studies and the development of social and marketing tools to influence road users. The joint use of the two directions yields the greatest effect. [2]. The implementation of a part of the project “Road safety in 10 countries (RS-10)” [2,3,4,5, 17] initiated by the World Health Organization jointly with the Global Road Safety Partnership and the Johns Hopkins University (USA) in 2010-2014 in Russia by Lipetsk State Technical University and the analysis of the obtained data showed that social marketing in the field of road safety has become an effective means of changing the behavior in risk groups [2,14]. Social marketing was conducted according to risk factors, such as, e.g. seat-belt use, and involved a widest audience. In practice, the most effective studies are those in social marketing [15, 16] which are based on statistical data.

The extent and quality of monitoring can be guaranteed only by involving scientists in these problems. The proposed studies, if conducted regularly, will provide the necessary information to improve legislation, as well as to develop, evaluate and increase the effectiveness of social marketing, being an important element of the “Safe system approach” [1].

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