



# Evidence-based and data-driven road safety management



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## ABSTRACT

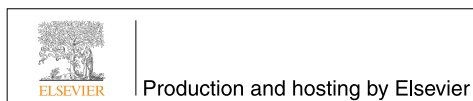
Over the past decades, road safety in highly-motorised countries has made significant progress. Although we have a fair understanding of the reasons for this progress, we don't have conclusive evidence for this. A new generation of road safety management approaches has entered road safety, starting when countries decided to guide themselves by setting quantitative targets (e.g. 50% less casualties in ten years' time). Setting realistic targets, designing strategies and action plans to achieve these targets and monitoring progress have resulted in more scientific research to support decision-making on these topics. Three subjects are key in this new approach of evidence-based and data-driven road safety management: ex-post and ex-ante evaluation of both individual interventions and intervention packages in road safety strategies, and transferability (external validity) of the research results. In this article, we explore these subjects based on recent experiences in four jurisdictions (Western Australia, the Netherlands, Sweden and Switzerland). All four apply similar approaches and tools; differences are considered marginal. It is concluded that policy-making and political decisions were influenced to a great extent by the results of analysis and research. Nevertheless, to compensate for a relatively weak theoretical basis and to improve the power of this new approach, a number of issues will need further research. This includes ex-post and ex-ante evaluation, a better understanding of extrapolation of historical trends and the transferability of research results. This new approach cannot be realized without high-quality road safety data. Good data and knowledge are indispensable for this new and very promising approach.

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## 1. Introduction

Over the past decades, road safety has continued to improve in many highly-motorised countries if measured by the number of road fatalities or road crash mortality rates (fatalities per 100,000 inhabitants), see Fig. 1.

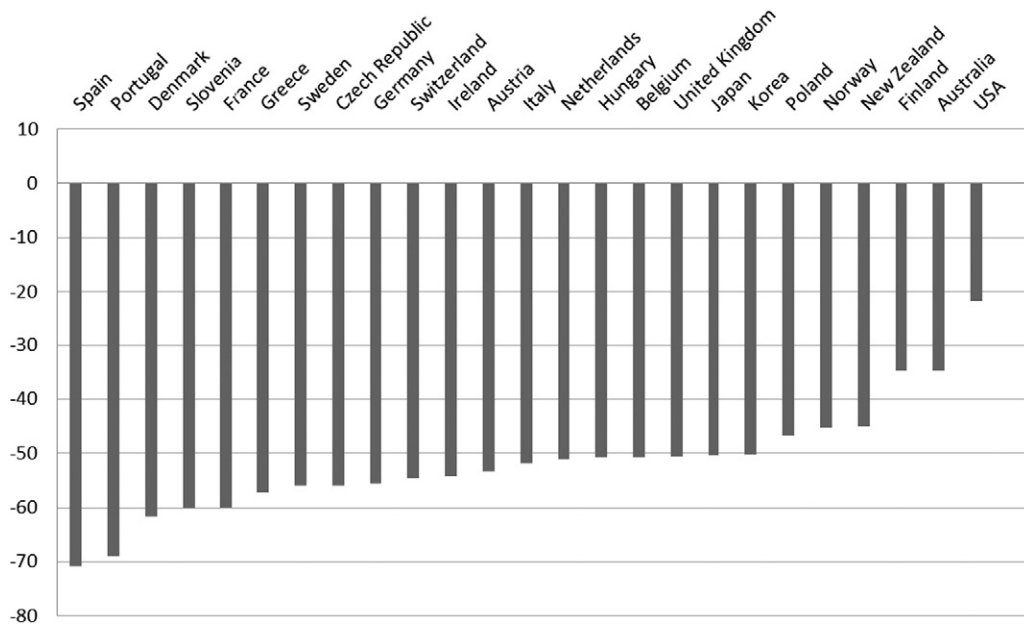


Fig. 1. Changes in number of fatalities 2000–2013 [1].

Johnston [2] argues that the critical success factors in nations with the lowest mortality rates or the largest progress are data-driven problem identification and the development of evidence-driven countermeasure packages formalised in a strategy for effective implementation, combined with ambitious, quantitative targets and transparent lines of institutional accountability. Road safety management captures all these components. However, although Johnston's view seems plausible, the question is whether enough scientific evidence can be found to support it.

The question how exactly the implementation of (a multitude of) road safety interventions has influenced the positive road safety developments in many countries, is not easy to answer. In a Special Issue of Safety Science on *Scientific Research on Road Safety Management* [3], a variety of approaches from different countries were presented. Subjects discussed included how to support decision-making for designing individual safety interventions, how to design strategies with multiple interventions in which interventions (could) interact, and how to evaluate implementations of individual interventions and of implemented strategies. The Editorial to this Special Issue [4] observed that the design and evaluation of road safety programmes appear not to be very popular topics amongst researchers, considering the limited amount of peer-reviews on the subject. Bax et al. [5] concluded that designers of road safety strategies make hardly any or no use at all of the results of these studies. However, we see a growing interest from both the research and the policy-making domains in this area. One of the reasons for this might be that more and more countries and jurisdictions are setting quantitative road safety targets (for example 50% less road fatalities in ten years). Data and knowledge are essential to set realistic targets. As those who set the targets are held accountable for reaching those targets, more and more attention is paid to monitoring progress over time and using the results to improve their performance further (Wegman & Hagenzieker, 2010).

This article explores three different subjects relevant for road safety management:

- Ex-post evaluation of individual interventions and of road safety strategies
- Ex-ante evaluation of individual interventions and of road safety strategies
- Transferability of research results (external validity).

For the exploration of these three subjects, we use the so-called SUN-flower approach. This approach presents a conceptual framework to find out what exactly causes road safety to improve in countries [6]. Koornstra et al. [7] started with a comparison between Sweden, the United Kingdom and the Netherlands. The comparison was later expanded by Wegman et al. [8] including six other European countries (Greece, Portugal, Spain, the Czech Republic, Hungary and Poland). The methodological approach is based on a road safety target hierarchy as shown in Fig2 and was adapted from a consultation document on the Road Safety Strategy 2010 of New Zealand [9]. This approach demands a fundamental understanding of traffic safety processes at different levels in the hierarchy of causes and consequences that lead to casualties (number of people killed or injured in a road crash) and of changes in them over time.

The vertical dimension is formed by the different levels in the pyramid. We have the final outcome of the system on top: i.e. the number of people killed and injured and the related social-economic costs. The level of safety measures and programmes reflects policy performance. Policy performance deals with the quality of a road safety strategy and the quality of its implementation. So, it is a combination of how well a strategy has been designed ('evidence-based and data-driven') and how well action plans based on a strategy have been implemented. Implementation of effective measures should lead to a higher safety quality of the road traffic system, which is reflected by a better design of system components and better operational traffic conditions. The indicators at this level are intermediate outcomes between policy output and the number of casualties (final outcomes) (Fig. 3).

Ex-post and ex-ante evaluations deal with the relation between policy output of interventions (safety measures and programmes) and final outcomes in terms of number of people killed or seriously injured and the associated social costs. Of course, this relationship should be a causal one: it should be possible to attribute changes in outcome indicator values solely to implemented interventions. It is advisable to distinguish between evaluation of individual interventions and packages of interventions, as is common practice when designing and implementing a road safety strategy. In case of ex-ante evaluations, we have to rely on research results from elsewhere, collected in different settings and at different times. The question is whether these results can be generalized. In other words: are the research results transferable and do we consider their so-called external validity to be sufficient? Sometimes we are able to collect specific data on the three subjects (ex-post evaluation, ex-ante evaluation and transferability of results),

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