Effectiveness of Setting Quantified Targets in Road Safety Strategies

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Introduction

- United Nations ESCAP classification
- Road safety strategy components
- Association between quantified target and fatality reduction
- Discussion and conclusion

Note: ESCAP – Economics and Social Commission for Asia and the Pacific

United Nations ESCAP Classification

Definitions

Degree of sophistication of road safety activities

- Phase I: Early stage
- Phase II: Intermediate stage
- Phase III: Advanced stage

Source: UN-ESCAP (2002) Road Safety Action Plans and Programmes. United Nation Economic and Social Commission for Asia and the Pacific, Thailand.

United Nations ESCAP Classification

Definitions

Phase I: Early stage

- Governments undertake the least sophisticated road safety activities
- Governments and the public pay little attention and spend few resources on road safety
- Such administrations do not have a formal road safety council, and the crash data records are elementary
- The main Phase I activities include
  - carrying out a road safety review to identify the scale, nature, and characteristics of the problem
  - bringing together all related parties to identify key steps and actions in a national seminar
  - establishing an interim working group (comprises senior staff of all parties represented at the seminar) to coordinate actions
  - and establishing a formal national road safety council to replace the interim working group
- Typical examples of countries undertaking Phase I activities are China and Indonesia

United Nations ESCAP Classification

Definitions

Phase II: Intermediate stage

- Governments show an interest in designing a strategy and an action plan to tackle road safety problems and ultimately to reduce the social cost of road crashes
- Typical Phase II activities usually involve
  - establishing an effective crash data system, strengthening the foundation of the national road safety council and other coordinating mechanisms
  - implementing “demonstration” projects (to provide training opportunities for key agencies and to set a model framework for future projects)
  - organizing study tours for senior representatives
  - developing the first five-year road safety program that consolidates measures in all areas of road safety
- More advanced administrations such as California in the USA, Japan, South Africa, South Korea, and Taiwan are undertaking Phase II activities

United Nations ESCAP Classification

Definitions

Phase III: Advanced stage

- Administrations have a solid ground for road safety development – an improved crash data system with
  - suitably trained staff handling it
  - a substantial amount of technical assistance and other resources
  - good coordination among road safety agencies
  - the participation of the general public
- The focus of Phase III activities is to consolidate Phase II activities, especially in developing a series of successive five-year plans, with quantified targets
- The actual implementation is usually in the form of annual national road safety plans, which are financed mostly by government funds rather than external sources
- The government is aware of the huge potential loss made by road crashes and is willing to spend part of its budget on road safety as an investment to reduce the social loss

United Nations ESCAP Classification

Definitions

Phase III: Advanced stage

- The effectiveness of the measures is evaluated and a monitoring framework is introduced to ascertain that the objectives of the plans are met
- Examples of such administrations include Australia, Finland, Holland, New Zealand, Sweden, and the UK

Road Safety Strategy Components

Nine-component comparative framework

Strategy formulation

- Vision
- Objectives
- Targets
- Action plan

Strategy implementation

- Evaluation and monitoring
- Research and development
- Quantitative modeling
- Institutional framework
- Funding

Source: Loo et al. (2005) Road safety strategies: A comparative framework and case studies. Transport Reviews, 25 (5), 613-639.

Road Safety Strategy Components

Nine-component comparative framework

Targets

- A target is a quantitative objective of the road safety strategy
- Targets are often expressed in the form of estimated percentages of reduction in accident rates or secondary parameters like seat belt usage rates
- Measures are then designed to achieve these target rates
- Similar to objectives, clearly defined targets can increase the likelihood of the policies that are being implemented, ensure the integration and coordination of efforts, and widen the scope of the strategy

Road Safety Strategy Components

Nine-component comparative framework

Examples of target settings

- Australia - Reduce the number of road fatalities per 100,000 of population by 40%, from 9.3 in 1999 to no more than 5.6 in 2010
- California - Overall programmed goal to reduce the mileage death rate to below 1.0 fatalities per 100 million vehicle miles by 2000
- Japan - Reduce the number of road fatalities to below the 1979 level of 8,466 by 2005
- New Zealand - Reduce social cost to $2.05 billion and fatalities to 295 by 2010
- Sweden - 400 deaths and 3,700 serious casualties for 2000, halve the number of 1996 fatalities by the year 2007
- United Kingdom - 40% cut in the number of people killed or seriously injured50% cut in the number of children killed or seriously injured10% cut in the slight injury rate by 2010

Association between Quantified Target and Fatality Reduction???

Quantified Target and Fatality Reduction

Before-and-after analysis

Data

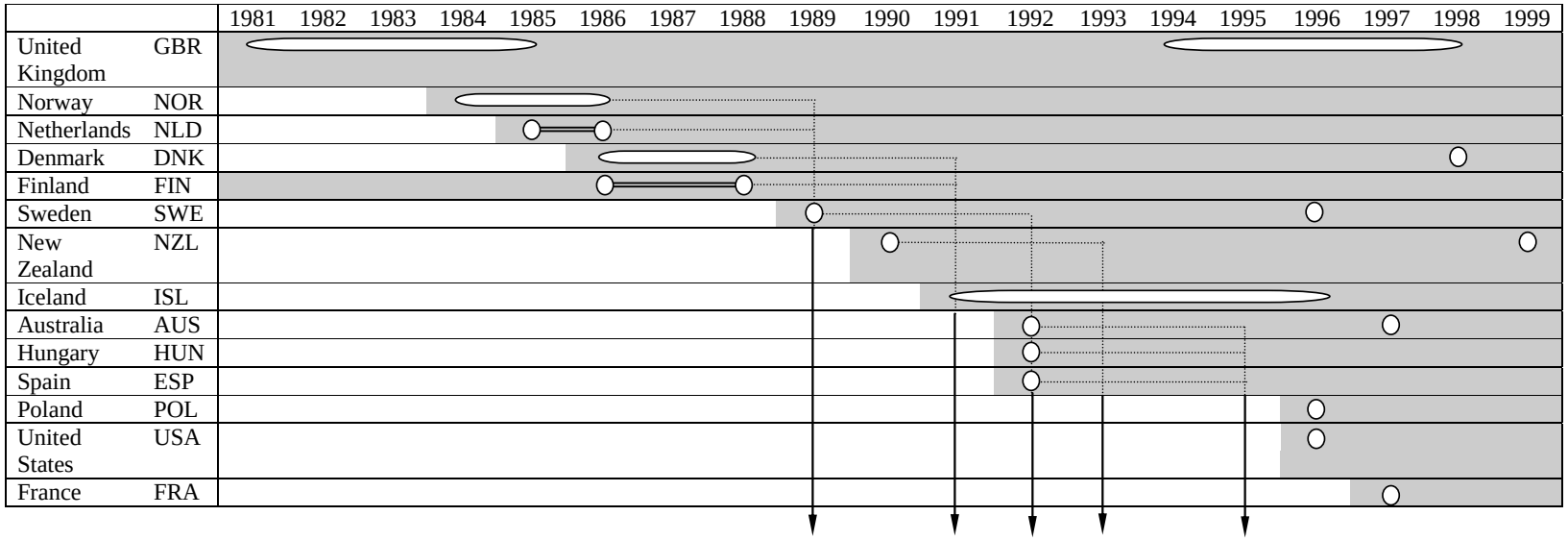
- Countries with quantified road safety targets are more successful in reducing road fatalities than countries without such targets?
- Fatality data are extracted from the World Road Statistics and International Road Traffic and Accident Database (IRTAD)
- Study period: 1981-1999
- 14 selected countries – United Kingdom (GBR), Norway (NOR), The Netherlands (NLD), Denmark (DNK), Finland (FIN), Sweden (SWE), New Zealand (NZL), Iceland (ISL), Australia (AUS), Hungary (HUN), Spain (ESP), Poland (POL), United States (USA), and France (FRA)
- Comparison countries – Countries that had not yet established a target but established a target at a later time

Source: Wong et al. (2006) Association between setting quantified road safety targets and road fatality reduction. Accident Analysis and Prevention, 38, 997-1005.

Quantified Target and Fatality Reduction

Before-and-after analysis

Potential comparison group



Treatment countries

NOR NLD		DNK FIN	SWE	NZL		AUS HUN ESP

Comparison countries

NZL ISL AUS HUN ESP POL USA FRA		AUS HUN ESP POL USA FRA	POL USA FRA	POL USA FRA		POL USA FRA

Quantified Target and Fatality Reduction

Before-and-after analysis

Quantification test

- The road fatalities in the treatment country are compared with the figures for the corresponding group of potential comparison countries with no quantified road safety targets for the period under consideration
- All of the countries concerned set their quantified road safety targets within the study period of 1981-1999, the treatment and comparison groups are likely to have similar characteristics in terms of the degree of road safety awareness among road users, authorities, and politicians; the level of resources that were committed to road safety; and attitudes toward the proper use of roads
- Nonetheless, we have taken great care in the selection of an appropriate comparison group, and conducted a qualification test to check the validity of the comparison countries, in which we evaluate the odds ratio for a pair of treatment and comparison countries between successive years before the target was set, to ascertain that the selected comparison country has a similar trend of fatalities with the treatment country at the 5% significance level (see Wong et al., 2005)

Source: Wong et al. (2005) Would relaxing speed limits aggravate safety? Accident Analysis and Prevention, 37, 377-388.

Quantified Target and Fatality Reduction

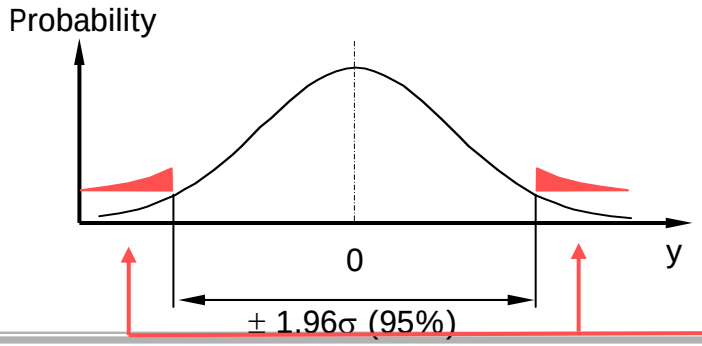
Before-and-after analysis

Quantification test

Consider the following time series data

Period	Number of fatalities in the treatment country	Number of fatalities in the comparison group
1	K_1	M_1
.....		
p	K_p	M_p
p+1	K_{p+1}	M_{p+1}
.....		
P	K_P	M_P
A target was set in Period P+1		

From these time series data



The odds ratio between period p and period p+1

$$r = \frac{M_{p+1}/M_p}{K_{p+1}/K_p}$$

If the comparison group is appropriately chosen, then the long-term expectation of this odds ratio is unity

To avoid negative probability, we define $y = \ln(r)$

The comparison group is rejected is the average of y falls within this ranges, at the 5% significance level

Quantified Target and Fatality Reduction

Before-and-after analysis

Quantification test

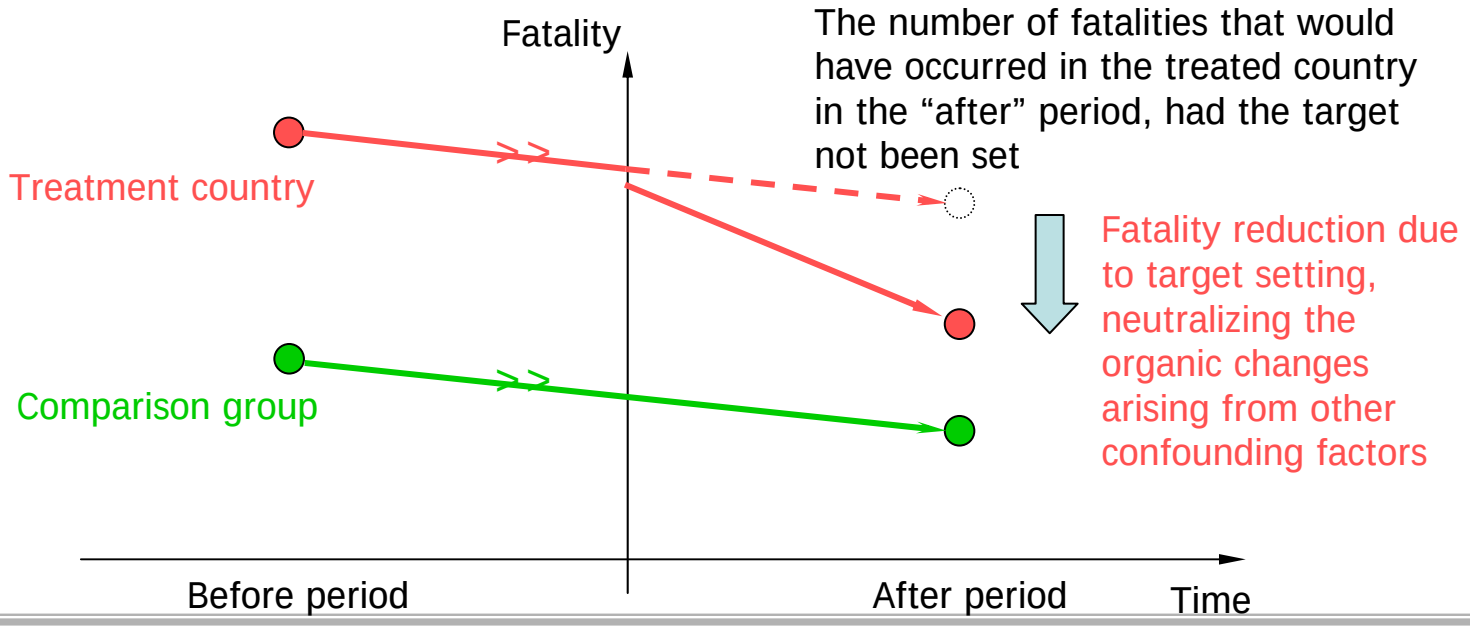
Treatment country	Period considered in the qualification test	Selected comparison countries that pass the qualification test at the 5% significance level	Odds ratio (aggregate)
Norway	1981-1983	Hungary, Spain, USA	0.85
The Netherlands	1981-1984	New Zealand, Iceland, Australia, Hungary, Spain, USA, France	1.01
Denmark	1981-1985	Australia, Spain	0.95
Finland	1981-1985	Australia, Spain	0.94
Sweden	1981-1988	Poland, USA, France	1.08
New Zealand	1981-1989	Poland, USA, France	1.01
Australia	1981-1991	Poland, USA, France	1.05
Hungary	1981-1991	Poland, USA, France	0.97
Spain	1981-1991	Poland	0.99

Quantified Target and Fatality Reduction

Before-and-after analysis

Hypothesis testing

- Null hypothesis: The treatment country did not experience a statistically significant reduction in the number of road fatalities
- Comparison group (CG) before-and-after analysis (Wong et al., 2005) was conducted, based on the numbers of fatalities in the treatment and comparison group, 3 years before and after the target was set



Quantified Target and Fatality Reduction

Before-and-after analysis

Hypothesis testing

Treatment country	Base year	Change in road fatality before and after the setting of quantified safety target	Level of significance
Norway	1984-1986	0.953 (↓ 5%)	Not significant
The Netherlands	1985-1986	0.789 (↓21%)	1%
Denmark	1986-1988	0.623 (↓38%)	1%
Finland	1986-1988	0.615 (↓39%)	1%
Sweden	1989	1.061 (↑ 6%)	Not significant
New Zealand	1990	0.912 (↓ 9%)	5%
Australia	1992	0.955 (↓ 5%)	Not significant
Hungary	1992	0.781 (↓22%)	1%
Spain	1992	0.847 (↓15%)	1%
Meta-analysis	-	0.826 (↓17%)	1%

Discussion and conclusion

- The setting of road safety targets is associated with a poorer road safety performance in Sweden, but the result is not significant, whereas all of the other cases show a reduction in fatality
- The overall mean fatality reduction from the meta-analysis is 17%, which demonstrates an appreciable improvement in safety performance
- The reliability of the results is justified by the carefully designed statistical quantification test
- It must be emphasized that the substantial reduction in fatalities and attendant safety improvement is unlikely to be the direct effect of the setting of a quantified safety target. The causal effect of efficient resource allocation to transport planning and the effectiveness of the safety programs that are initiated to meet an appropriate target are more critical to success (Loo et al., 2005)
- However, a quantitative road safety target serves as an effective catalyst that motivates policy makers and stakeholders to support road safety initiatives to achieve the safer use of roads
- It helps to raise concern about road safety in societies, encourages decision-makers to formulate effective road safety strategies, and ensures that sufficient resources are allocated to road safety programs
- Future work: Is the effect of quantified road safety target sustainable?