Towards a method to forecast the effectiveness of national road safety programmes

FERSI Training Seminar on Evaluation
19-21 May 2010, Bern, Switzerland

Stefan Siegrist, Ph.D., Deputy Director

bfu – Swiss Council for Accident Prevention
s.siegrist@bfu.ch – www.bfu.ch

Introduction

- trend:
  authorities are required by law to prove the effectiveness of changes in legislation and of capital investment in road safety or other public health programmes
- e.g. Switzerland: article 170 of the Federal Constitution of the Swiss Confederation states:
  “The Federal Assembly shall ensure that federal measures are evaluated with regard to their effectiveness” (introduced 1 January 2000).

Introduction

- international comparison of the evaluative function in 22 countries:
  high standard only in those countries that already developed their evaluation policy in the late sixties (e.g. USA, Canada, Sweden, the Netherlands) (Furubo et al., 2002)
- evaluation is not yet a planning instrument in many countries

Introduction

why evaluation is not yet a planning instrument?

- no tradition, not enough experience
- diffusion of responsibility (joint responsibility of federal, cantonal and local authorities for road safety matters)
- limited use of results for single measures
  (usually no information about how comprehensively the measure was implemented, the original level of safety, other measures that were launched at the same time, etc.)

Introduction

method for estimating/forecasting the safety outcomes of intervention programmes still missing:

- focus on single measures:
  Jagtman et al. (2006): interesting method of ex-ante assessment of single safety measures: HAZOP (Hazard and Operability Analysis)
- focus on just one aspect:
  cost-efficiency of measures (e.g. Yannis et al., 2008)

question not answered:
how can evaluation studies be of greater benefit in the planning and political realization of road safety programmes?

Evaluation of single full-coverage measures

- state intervention: no control group available
- “Thus, the task of identifying target and comparison accidents properly overshadows in its importance the statistical questions ...” (Hauer, 1997, p. 44).
- determin the theoretical potential of a measure: reduce the target number of injuries (defined as severe and fatal injuries) to only those that should be reduced by the measure
- e.g. obligatory bicycle helmets for children up to the age of 14: all cranio-cerebral injuries incurred as a result of a bicycle accident by children in this age group, for a given year

Ex-ante evaluation: Forecasting the effects of a national road safety programme

- scientific evaluations of single measures or broader programmes are retrospective in nature
- common sense:
  measures that have been proven to be effective should be used in evidence-based policy making
- problem: translating one result to another situation
- effectiveness of the safety measure but one factor
- programmes consist of several measures: take account of combined effects

Estimating the effect of a single measure

A Potential number of (severe and fatal) injuries that could be influenced by the measure:
What is the target number of serious injuries and fatalities (theoretical potential of a measure)?
(e.g. measure 'evidential breath testing': all injuries where alcohol played a role)

B Area of theoretical impact:
What proportion of the target number of injuries can the measure actually be applied to (because the measure has not already been realized for this proportion, or because there are no limitations on its application)?
(e.g. all cranio-cerebral injuries of cyclists (A), reduced by the share of children already wearing helmets).

Estimating the effect of a single measure

C Effectiveness:
What share of serious injuries and fatalities can be prevented if the measure is implemented?
(e.g. measure ‘zero alcohol for novice drivers’: all alcohol-related injuries – caused by novice drivers – that would not occur if there were no new drivers driving under the influence of alcohol [attributable risk])

D Degree of implementation:
In the given circumstances, what is the maximum and the average spread of the measure that can be expected over a certain period of time?
(e.g. measure ‘improvement of ungated railway crossings’: the proportion that have been improved within a certain timeframe).

Estimating the effect of a single measure

E Degree of compliance:
What is the maximum and the average uptake by road users that can be expected over a certain period of time, assuming that a way of circumventing the measure exists?
(e.g. measure ‘campaign to increase the wearing of seat belts’: the proportion of drivers and passengers who buckle up as a result of the intervention).

Estimating the effect of a single measure

Actual reduction

= A x (B/100) x (C/100) x (D/100) x (E/100)

e.g. “obligatory seat belt-ignition-interlock system in CH”

Maximum number of preventable fatalities per year = 136 x 1 x 0.45 x 1 x 0.95 = 58

Average number of preventable fatalities per year = 136 x 1 x 0.45 x 0.5 x 0.95 = 29

Estimating the effect of a whole programme

Step one:

If measure is not fully realized within a given period (maximum spread, maximum compliance):

estimate an average value for the degree of implementation and compliance for the ten-year period

particularly necessary for technical measures (implementation is time-intensive) and measures requiring behavioural change (compliance increases slowly)

Estimating the effect of a whole programme

Step two:

adjusted the value obtained in step one:

account for the extent to which the effects of the measures overlap

choose model of combined effect:
additive, independent, **correlated, dominated** (Elvik, 2009)

check every single measure referring to A to E

Estimating the effect of a whole programme

Step two:

e.g. measures
'speed limit 70 km/h on selected stretches of rural road' and
'central barriers on selected stretches of rural road'

define the proportion of road covered by both measures

define the proportion of preventable injuries that occur on these sections

remove double effect

Swiss experience:

overlap particularly for vehicle occupants

average reduction factor was 45 per cent

Estimating the effect of a whole programme

Step three:

Estimate synergy effects

- when a government policy has a more positive influence on the awareness of a problem and prevention behaviour than that seen previously for single activities
- know-how and organisational solutions that are developed for one measure can be carried over to others

Swiss experience:

- the 45 per cent reduction from step two can be reduced to an estimated 35 per cent

Discussion and conclusions

- politicians have finite interest in the performance of a measure in another country, at another time and under other circumstances
- many valuable results not optimally employed in the planning of safety programmes
- we need a method for the estimation of the injury reduction potential of a safety programme

Discussion and conclusions

Method outlined has some shortcomings:

- variable reliability of data
  - declare estimates as such
  - collect representative information on safety-related indicators
  - present results as a range
- difficulty in estimating the combined effect of measures
  - assume that effects of measures are correlated
  - make an estimate of overlap (dominant common residual model)

Discussion and conclusions

Method outlined has some shortcomings:

- take into account the trend in accident rates more carefully

- quality assurance measures
  - conduct cost-benefit-analysis and attributed quality assurance measures to the side of ‘costs’

Methodological shortcomings limit the validity of the results.

Discussion and conclusions

Method outlined here nevertheless represents an improvement for forecasts in comparison to the uninformed use of single evaluation results.

All relevant parameters are determined for the conditions in a real situation and the connections between them are accounted for in a transparent way.