

Summary:

Speed limit changes. Effects on speed and accidents

Introduction

In the autumn of 2001, speed limits were lowered from 80 km/h to 70 km/h and from 90 km/h to 80 km/h on hazardous road sections in Norway. These road sections had been identified as having a high expected injury severity density (based on accident costs pr km), i.e. a high number of fatal or serious injury accidents per kilometre of road. In this report we evaluate how these changes in speed limits have affected speed and accidents.

Procedures for identifying roads

Formal procedures were developed to identify road sections where speed limits were to be lowered. These procedures were based on injury severity density, which is a measure of the frequency of accidents leading to fatal or serious injuries.

Additional criteria were developed for roads with a current speed limit of 90 km/h, relating to highway alignment, ADT, road width and roadside development. The criteria were intended to identify those road sections in Norway that had the worst safety problems, as targets for lowered speed limits.

The speed limit were lowered on 294 road sections

Speed limits were lowered on 294 road sections with a total length of 1,134 km. 247 road sections (total length 741 kms) had the speed limit lowered from 80 km/h to 70 km/h. 47 road sections (total length 393 kms) had the speed limit lowered from 90 km/h to 80 km/h.

Before-and-after study

Effects were evaluated by means of a before-and-after study employing the Empirical Bayes design. The normal number of accidents or injured road users on the treated roads was estimated by means of a multivariate accident prediction model. The normal number of accidents or injured road users was then combined with the recorded number of accidents or injured road users on each road section in order to estimate the long-term expected number of accidents or injured road

users. The difference between the recorded number of accidents or injured road users and the long-term expected number of accidents or injured road users shows the expected regression-to-the-mean effect. All estimates of effect have controlled for regression-to-the-mean.

In addition, the study controlled for long-term trends in accident occurrence by applying two comparison groups. These groups were defined as follows:

1. Comparison group 1 consisted of roads that retained the original speed limit of 80 km/h (alternatively 90 km/h)
2. Comparison group 2 consisted of all public roads in Norway (minus those that had the speed limit lowered).

Comparison group 1 is matched to the treated group with respect to speed limit. Changes in the number of accidents or the severity of injuries from the before-period to the after-period in this comparison group will reflect trends that are specific to roads that have a speed limit of either 80 km/h or 90 km/h. Comparison group 2 is much larger than comparison group 1, but will adequately reflect trends that apply to all public roads, and not trends for a specific type of road that depart from the overall pattern.

Neither of the two comparison groups is considered fully satisfactory. Hence, effects have been estimated by means of both groups.

Data on changes in speed

Data on changes in speed have been taken from permanent traffic monitoring stations operated by the Public Roads Administration. There are more than 200 of these stations in Norway, and data from 29 of them have been used. A computer algorithm was developed in order to ensure that only data of acceptable quality was used in the study. Errors in speed data occur at a higher rate than is currently believed.

Comparison road sections for the speed study were found in the same county and with ADT levels similar to the treated roads. The speed limits were unchanged on the comparison roads.

Table S1 shows the number of vehicles included in the speed data. As can be seen from Table S1, valid speed data were obtained from several million vehicles.

Table S1: Number of vehicles at treated locations and comparison locations for which valid speed data have been obtained

Group	Number of vehicles	
	Before	After
Treated roads	19,691,569	20,358,041
Comparison roads	8,674,886	9,008,759
Total	28,366,455	29,366,800

Source: TØI report 729/2004

Effect on speed

Changes in mean speed are shown in Table S2. As can be seen, mean speed was reduced in all groups. The reductions were somewhat larger in the two treated groups (80 km/h to 70 km/h and 90 km/h to 80 km/h) than in the two comparison groups. This indicates that lowering the speed limit had a net effect on speed.

Table S2: Mean speed before and after changes in speed limits

Group	Mean speed (km/h)	
	Before	After
Treated roads 80 km/h to 70 km/h	75.3	71.2
Comparison roads retaining 80 km/h	76.4	74.4
Treated roads 90 km/h to 80 km/h	85.1	82.2
Comparison roads retaining 90 km/h	84.6	83.4

Source: TØI report 729/2004

The net reduction in mean speed attributable to the lowering of the speed limit can be estimated to between 4.1 km/h and minimum 2.1 km/h on roads that had a speed limit of 80 km/h before treatment. The corresponding net reduction in mean speed on 90 km/h roads can be estimated to between 2.8 and 1.6 km/h.

Accident data

The accident data for the treated road sections are presented in Table S3. The before-period included all years from 1993 to 2000, i.e. 8 years. The after-period started at slightly different dates in late 2001 and included the years 2002 and 2003. The mean duration of the after-period was about 2 years and one month.

In total, about 3,700 injury accidents served as the basis for the evaluation. As can be seen from Table S3, the data for some of the categories during the after-period was quite sparse, leading to uncertain estimates of effect.

Table S3: Accident data for treated road sections

Group	Item of data	Before	After
80 km/h to 70 km/h	Total days covered	589,496	148,403
	Injury accidents	2307	455
	Fatalities	211	30
	Critically injured road users	133	4
	Seriously injured road users	404	66
	Slightly injured road users	2949	680
90 km/h to 80 km/h	Total days covered	99,280	27,230
	Injury accidents	718	257
	Fatalities	108	32
	Critically injured road users	43	10
	Seriously injured road users	188	64
	Slightly injured road users	954	373

Source: TØI report 729/2004

The number of accidents or injured road users in the comparison groups were substantially higher than in the treated groups. This applied both to comparison group 1 and comparison group 2.

Effects on accidents and injured road users

Table S4 summarises estimated effects on accidents and injured road users of the changes in speed limits. Effects are stated as percentage changes in the number of accidents or injured road users.

On roads where the speed limit was lowered from 80 km/h to 70 km/h, there has been a reduction of both accidents and the number of injured road users. The size of the reduction attributed to the change in speed limit, labelled net change and shown in two columns to the right in Table S4, differs slightly depending on whether comparison group 1 or comparison group 2 is used to account for long-term trends. By and large, however, the two sets of estimates are quite close. The largest reduction is found for fatalities and critical injuries. This makes sense in view of previous studies of the effects of lowering speed limits.

On roads where the speed limit was lowered from 90 km/h to 80 km/h, the findings are more difficult to interpret. There has apparently been an increase in both the number of accidents, the number of fatalities and the number of seriously or slightly injured road users. When regression-to-the-mean and long-term trends are controlled for by means of comparison group 1, a net increase remains for accidents, seriously injured road users and slightly injured road users. There is a net reduction of the number of fatalities and critically injured road users. If comparison group 2 is used, there is a net increase at all levels of injury severity.

Table S4: Effects on accidents and injured road users of changes in speed limits.
Percentage changes

	Percentage change by source of change in the number of accidents or injured road users					
	Gross change	Regression-to-the-mean	Long-term trend, comparison group 1	Long-term trend, comparison group 2	Net effect based on comparison group 1	Net effect based on comparison group 2
Roads where speed limit was lowered from 80 to 70 km/h						
Accidents	-21	-7	0	-2	-16	-14
Fatalities	-43	-24	27	-1	-42	-25
Critically injured	-88	-35	-16	-21	-78	-77
Seriously injured	-35	-10	-5	-17	-23	-12
Slightly injured	-8	-2	5	0	-10	-6
Roads where speed limit was lowered from 90 to 80 km/h						
Accidents	31	-5	-8	-2	50	41
Fatalities	9	-15	64	-1	-22	29
Critically injured	-15	-5	26	-21	-29	13
Seriously injured	25	-15	8	-17	36	78
Slightly injured	43	-2	-11	0	64	45

Source: TØI report 729/2004

The findings for roads where speed limits were lowered from 90 km/h to 80 km/h do not make much sense, and are strongly influenced by the choice of comparison group. Neither of the two comparison groups used can be considered ideal. Reasons for the dramatic increase in the number of fatalities in comparison group 1 (64%) are not known. If real, this increase is a sign of a drastic deterioration of road safety on roads that retained the 90 km/h speed limit. A similar tendency, but less pronounced, is seen on roads that retained the speed limit of 80 km/h (27% increase).

Conclusions

It is concluded that lowering the speed limit from 80 km/h to 70 km/h on hazardous road sections in Norway has successfully reduced both speed, the number of injury accidents and the number of injured road users. The reduction is largest for fatalities and critical injuries. The effects are statistically significant at the 5% level.

The effects of lowering the speed limit from 90 km/h to 80 km/h are less clear. A reduction in speed has been found, but it was smaller than the reduction associated with lowering the speed limit from 80 km/h to 70 km/h. Overall, no reduction in the number of accidents or injured road users has been found. No effects are significant.