Methodological notes PIN Flash on behavioural indicators

Estimation of road deaths reduction potential for average speed reductions

We have used so called Nilsson model according to which a change in a speed will result in a change in road deaths in proportion to the fourth power of average speed.

Road type	Average speed light vehicles reported by PIN panellists		Reduction road deaths from 1km/h speed reduction		Deaths in 2008	Deaths prevented
	Speed range	Typical speed	Range	Typical		
Rural	81-95	86	4.3 - 5.1%	4.8%	20,880	1,000
Urban	42-56	48	7.5 - 10.1%	9.4%	12,240	1,150
Motorways	108-118	112	3.5 - 3.8%	3.7%	2,880	105
All roads						2,255 (6%)

Rural roads - speed range based on only those with speed limit of 90 km/h
Urban roads - speed range based on roads with 50 km/h speed limit
Motorways - speed range based on roads with various speed limits 110-130 km/h

If the average speed of all vehicles dropped by 1 km/h on all roads in Europe, than over 2,200 road deaths would have been prevented, comprising about 1,000 on rural roads, 1100 on urban roads and 100 on motorways.

The number of road deaths per road type in 2009 will be updated using latest CARE data. The numbers used for calculation so far are the estimates based on the known proportion of road deaths in each road type in 2006 and 2007.

Estimation of deaths prevented by eliminating drink driving - BAC > 0.5g/l

Alcohol-related deaths in EU-27 reported by panellists in 2008 ….4,374
Total road deaths in 2008 …. 37,899 (11.54%)

Assuming that the risk of road deaths from crashes in which at least one participants had a BAC > 0.5 g/l would be reduced by at least 80% if those drivers had not been drinking, then one can estimate that this reported number of deaths could be reduced by at least 80% if driving after drinking is eliminated from road traffic.

R=4.374 * 0.8 = 3,500

If those driving over the 0.5g/l had instead not been drinking, the number of road deaths in 2008 would have been reduced by at least 3,500.

Estimation of car occupants' lives saved through (increased) seat belt use

Based on the seat belt wearing rate and effectiveness, as well as the number of occupants killed in road crashes in an existing situation, the estimated number of occupants' lives that would be saved if the situation changed is calculated using a method developed by Chris Schoon (SWOV) and Richard Allsop (University College London). The method is presented for car drivers and then applied for all types of car occupants.

Schoon, C.C. *Toelichting op rekenprogramma's 'Besparing slachtoffers bij gebruik van beveiligingsmiddelen'*. SWOV-report D-94-13,1994, and ETSC 1st Road Safety PIN Report 2007

Lives saved if the accident rate is independent of seat belt wearing

Assuming that wearing a seat belt cuts by half the number of drivers who would die in potentially fatal accidents, and a proportion D1 of drivers is wearing belts in an existing situation, then the number S1 of drivers who are actually killed in crashes can be calculated as

$$S1 = N*(1-D1*0.5)$$

where N is the number of drivers who would be killed in that situation if none wore belts. Then

$$N = S1/(1-D1*0.5) \qquad (1)$$

The same holds for another situation, in which a proportion D2 of the same drivers is wearing belts.

$$S2 = N*(1-D2*0.5) \qquad (2)$$

To calculate the lives saved in the new situation based on data for the old situation, we substitute (1) in (2).

$$S2 = S1*\{(1-D2*0.5)/(1-D1*0.5)] \qquad (3)$$

The number of lives saved through the difference in seat belt wearing between the two situations is:

$$B = S1 - S2 \qquad (4)$$

Substituting (3) in (4), this number is

$$B = S1*(D2 - D1)*0.5/(1 - D1*0.5)$$

To estimate the number of lives saved through existing seat belt use, D2 is taken to be zero and the absolute value of B is the required estimate. To estimate the number of lives saved through a maximum use of 99%, D2 is taken to be 0.99.

Lives saved if non-wearers have a higher accident rate than wearers

If the accident rate for unbelted drivers is X times that of belted drivers in both situations, and N is now the number of drivers that would be killed in the existing situation if all drivers had the accident rate of the belted drivers but none wore belts, then the number if drivers killed in the existing situation is

$$S1 = N*[(1 - D1)*X + 0.5*D1] \quad (5)$$

and the number of drivers killed in the new situation would be

$$S2 = N*[(1 - D2)*X + 0.5*(D2 - D1)*X + 0.5*D1] \quad (6)$$

It then follows that

$$B = S1*0.5*(D2 - D1)*X/[(1 - D1)*X + 0.5*D1]$$

As before, to estimate the number of lives saved through a maximum use of 99%, D2 is taken to be 0.99. Increased risk on the part of unbelted drivers in the existing system has no effect on the estimate of the number of lives saved through existing seat belt use.

Number of killed car and other light vehicle occupants in EU-27

To estimate the number of lives saved with seat belts, the number of killed occupants is required. At the level of EU-27 countries, the number of occupant deaths in 2009 must be estimated from data available in CARE. The estimation has been done in the three steps:

1. The number of killed drivers in light vehicles in 2008 for EU-27 is available from CARE database. The only missing value for Cyprus was estimated as 28. (This corresponds to34.5% of all road deaths - as the average in EU-27 countries) 12,540
2. The number of killed front seat passengers and rear seat passengers separately is available in 15 EU countries. In these countries, they total 2,028 and 1,336 deaths respectively, while the number of killed drivers in these countries is 7,507. From these numbers, one can extrapolate the numbers of killed front seat and rear seat passengers in 2008 in EU-27 countries as 3,388 and 2,232 persons.
3. To estimate the number of killed light vehicle occupants in 2009 for the EU-27, one can assume that the reduction in the total number of deaths between 2008 and 2009 of 8.64% applies also for the category of light vehicle occupants: then the numbers of killed drivers and front seat and rear seat passengers in light vehicles in 2009 are estimated as: 11,457 / 3,095 / 2,039.

Occupants	Light vehicle occupant deaths	Current seat belt wearing rate (%)	New seat belt wearing rate (%)	Belt effec-tiveness (%)	Lives saved at current wearing rate	Extra lives saved with a 99% wearing rate	Proportion of current deaths (%)	Lives saved with a 99% rate and risk factor 1,5	Proportion of current deaths (%)
	D	CR	NR	E	X_{CR}	X_{NR}		X_{NRIR}	
Driver	11,457	88	99	50	9,002	1,125	9.8	1,525	13.3
Front passenger	3,095	88	99	50	2,432	304	9.8	411	13.3
Rear passenger	2,039	64	99	50	960	525	25.7	622	30.5
Total					12,394	1,954		2,558	

Data on the number of light vehicle occupant deaths apply for EU-27 countries in 2009. Current seat belt wearing rate in the EU-27 was estimated for 2008 data. National values or estimates were weighted according to the annual number of passenger car kilometers in a given country in 2007 (EU energy and transport in figures: Statistical pocketbook 2009, DG TREN, EC).

In Europe, an estimated 12.400 deaths were prevented by using a seat belt among light vehicle occupants in 2009 and about 2000 more deaths could have been prevented if 99% of occupants had been wearing a seat belt and the accident risk of current non-wearers were the same as that of current wearers. If the accident risk of current non-wearers were higher by a factor of 1.5, then about 2500 deaths could have been prevented if 99% of occupants had worn their belts.

<u>Formulas applied in the table above were the followings:</u>

X_{CR}=-(D*(-CR/100)*E/100/(1-CR/100*E/100))

X_{NR}= (D*(NR/100-CR/100)*E/100/(1-CR/100*E/100))

X_{NRIR}=D*((1-CR/100)*1,5-(1-NR/100)*1,5)*(E/100)/((1-CR/100)*1,5+(1-E/100)*CR/100)