

INTELLIGENT SEATBELT REMINDERS: DO THEY CHANGE DRIVER SEAT BELT USE IN EUROPE

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ABSTRACT

The objective was to study if there were differences in driver's seat belt wearing rates between cars with and without Seat Belt Reminders (SBRs), and if there were differences in wearing rates between some different European countries indicating that the potential in saving lives could vary between the countries.

The influence on seat belt wearing rates of SBRs fulfilling the Euro NCAP specification was studied in seven EU countries; Belgium, Denmark, France, Germany, Italy, Spain and Sweden. The same observer performed all observations and he noted if the seat belt was used and the car model observed. In total 11160 cars were observed. The measurements were only made in cities and did only concern driver SBR.

For all observations the total seat belt wearing rate was 97.5% in cars with SBR, while it was 85.8% in cars without. The results indicate that the number of unbelted car occupants is decreased by 80% independent of the wearing rate. The highest wearing rate in cars with SBRs was found in Paris, 99.8%, and the lowest in Brussels, 92.6%. The results support previous estimations that more than 7000 lives could be saved every year in the EU if all cars were fitted with SBRs. Therefore actions aimed at increasing the fitment rates of SBRs are desirable.

Previously it has been estimated that SBRs are one of the most cost effective measures to save lives. The results in this study support the estimation.

BACKGROUND

It is widely recognised that the seat belt is one of the most important safety inventions. Kahane (2000) estimates the risk reduction associated with seat belts in cars to 45 percent

in passenger cars and 60 percent in light trucks. The current wearing rate saves thousands and thousand of lives every year.

Most countries has a mandatory use of seat belt legislated. In Europe there is a seat belt directive. However the seat belt use is not 100% in those countries. The seat belt wearing rate for drivers and front seat passengers in Europe was estimated to an average of 76 % in 2003 (ETSC 2003). For passengers in the rear seat the estimate is 46%. The variations are significant. For front seat occupants in Europe in 2004 it varied from 59% and 96% (ETSC 2006a).

It is clear that significant safety gains could be achieved if more or all car passengers were to use the seat belt.

The European Transport Safety Council (ETSC) has previously calculated the potential of seat belt reminders. In the European Union (EU-15) 7600 lives could be saved per year in 1996 if all used seat belts. In the USA the potential is also high and it has been shown that another 8000 lives would have been saved if all used their seat belts (Glassbrenner 2003). Even in countries with a high seat belt use the remaining potential is high. In Sweden with a 92% seat belt use, almost 40% of those killed as car occupants were unrestrained SRA (2005 & 2006). In Australia, with an overall seat belt use of 95%, 33% of those killed in car crashes were unrestrained Fildes et al (2002).

After some initial work performed by Folksam research in Sweden, the Swedish Road Administration together with Swedish car manufacturers and research institutes started a co-operation around improved seat belt reminder systems in 1995. The joint effort resulted in a shared understanding that improved seat belt reminders could play an important role to increase seat belt use (Turbell et al 1996).

Based on the Swedish experience the European Enhanced Vehicle-Safety Committee (EEVC) initiated a work around seat belt reminders. The working group 16 (EEVC/WG16) reported a set of recommendations in 2002. These recommendations formed the basis for Euro NCAP when developing the first seat belt reminder protocol

Before introducing the smart seat belt reminder, studies were conducted to analyse reasons for non-belt use. In Sweden, Dahlstedt (1999) showed in a combination of an observational and interview study, that only a very small fraction (less than 0,1% of the whole population and approx 1% of the nonusers) was against seat belts on a more principal level. The most common reasons for not using seat belts were simply that they were forgotten, or that the trip was short.

There are similar results from the USA, where it has been reported that approximately only four percent of the drivers are against using a seat belt, and where 87% strongly agree that they would want to be wearing a seat belt in a crash (TRB report 278). Ferguson et al. (2006) found that nearly 90% of drivers having cars with seatbelt reminders would like one in their next car.

Since 2002 the consumer crash protection programme in Europe, Euro NCAP, gives premium to cars having seat belt reminders. The requirement is that a loud and clear light and sound signal should be active for at least 90 seconds if the seat belt is not worn. Euro NCAP gives separate points for the driver, front seat passenger and rear set passenger. The demand for the rear seat is lower and does not demand audio signal.

In June 2002, the first car with such a system for the driver was introduced, quickly followed by more. In all, Euro NCAP has given points to 96 cars (Nov 2006). ETSC has estimated the proportion of new cars sold with seat belt reminders in EU. In 56% of the cars sold in 2005 there was a seat belt reminder (ETSC 2006b). ETSC found large differences between the different countries. Sweden had almost 70% of the new cars sold in 2005

having seat belt reminders and the Czech Republic only around 30%.

Krafft et al. (2005) reported a study on the effect of seat belt reminders in Sweden in 2005. That data set is a part of this study. The analysis showed that seat belt reminders made a significant difference in seat belt use in Sweden. The seat belt use for cars not equipped with seat belt reminders was 82,3 +/- 1,9%. For cars with seat belt reminders the seat belt use was found to be 98,9 +/- 0,8%.

Ferguson et al. at Insurance Institute for Highway Safety reported in 2006 a study on the seat belt use in Honda cars. They compared the seat belt use in models without seat belt reminders from 2002-04 and cars with seat belt reminder 2004-06 model year. The research showed a change in seat belt use from 84% to 90%.

The aim of the present study was to evaluate if the presence of a smart seat belt reminder (SBR), increase the driver seat belt wearing rate in traffic in some European cities.

METHOD/MATERIAL

The study was performed in two steps, in July 2005 (Sweden) and in May 2006 (Europe). Using Swedish experience it was assumed that the seat belt use is lower in built up areas than in rural areas. To find the minimum effect of seat belt reminders the observations were conducted in built up areas. The observations were conducted in seven countries within the European Union. In Sweden, the observations were made in five cities spread across Sweden, see Table 1. In the other six countries the observations were made only in one city in each country, see Table 1.

To avoid any inter-observer bias all observations were performed by the same observer,. The observer was trained to discriminate between different car models, and was also instructed to note what car that was observed. The observer was also instructed to only note cases that were clear. Any uncertainties about seat belt use and car model were omitted from the observations. Car model and driver seat belt use was recorded.

Table 1. Countries and cities where the observations were made.

Observation	Country	City/cities
May 2006	Belgium	Brussels
May 2006	Denmark	Copenhagen
May 2006	France	Paris
May 2006	Germany	Berlin
May 2006	Italy	Milan
May 2006	Spain	Barcelona
July 2005	Sweden	Karlstad, Örebro, Luleå, Sundsvall and Stockholm

Three groups of cars were defined (the cars studied in each category are listed in the Appendix):

- The first group contains cars that fulfil the Euro NCAP protocol for the driver's seat and have been approved by Euro NCAP (Euro NCAP 2004). They all have seat belt reminders that have a visual signal and a loud and clear audio signal. If the driver is unbelted the signals must be active for at least 90 seconds.
- The second group contains cars with visual reminders and some low intensity audio signal. The sound signal does not fulfil the Euro NCAP protocol's demands for loud and clear.
- The third group contained cars without any reminder. The latter group was defined in such a way that it should be similar as to size and age, when compared with the group with reminders.

No control for driver age, gender or socio-economic status was performed in this study.

In total 11160 cars were observed, where the seat belt use of the driver was noted. Statistical tests were carried out comparing the proportion of seat belt usage (student's t-test for proportions).

RESULTS

A significant difference in seat belt wearing rate was found. For all observations the total seat belt wearing rate was 97.5% in cars with SBR, while it was 85.8% in cars without, see Table 2. The results indicate that the number of unbelted car occupants is decreased by 80% independent of the wearing rate.

The wearing rate in cars with mild reminders was 93.2%, indicating that the levels of the audio and visual reminder signals are of importance. The highest wearing rate in cars with seat belt reminders was found in Paris, 99.8%, and the lowest in Brussels, 92.6%. The results are presented in Table 2.

In cars fitted with seat belt reminders and still with unbelted drivers, some manufacturers appear to be over-represented, see Table 3. The differences are, however, not statistically significant.

Table 2. Numbers of observed drivers for cars with and without a seat belt reminder (SBR), drivers with seat belts used, and the associated seat belt use in percent.

	Denmark/Copenhagen				Belgium/Brussels				France/Paris				Spain/Barcelona			
	total	n	belted n	belt use %	total	n	belted n	belt use %	total	n	belted n	belt use %	total	n	belted n	belt use %
Cars with SBR	326		319	97,9	526		487	92,6	512		511	99,8	491		484	98,6
Cars with mild SBR	42		39	92,9	42		36	85,7	19		19	100,0	21		19	90,5
Cars without SBR	652		580	89,0	869		605	69,6	897		869	96,9	757		690	91,1
	Italy/Milan				Germany/Berlin				Sweden/5 cities				Total			
	total	n	belted n	belt use %	total	n	belted n	belt use %	total	n	belted n	belt use %	total	n	belted n	belt use %
Cars with SBR	463		452	97,6	446		431	96,6	734		726	98,9	3498		3410	97,5
Cars with mild SBR	35		34	97,1	35		35	100,0	729		678	93,0	923		860	93,2
Cars without SBR	894		770	86,1	1044		932	89,3	1626		1339	82,3	6739		5785	85,8

Table 3. Numbers of belted and unbelted drivers in cars fitted with SBR for the included car models.

Make	Model	Year	All cities		
			seat belt used	seat belt not used	un-belted %
Alfa Romeo	159	2005	16	1	6
Audi	A3	2005-	159	4	2
Audi	A4	2005-	174	7	4
Audi	A6	2004-	175	9	5
Citroën	C4	2004-	105	4	4
Citroën	C5	2005-	54	5	8
Ford	C-Max	2005-	105	4	4
Ford	Focus II		168	0	0
Nissan	Micra	2003-	120	4	3
Peugeot	407	2004-	179	2	1
Toyota	Avensis	2003-	131	3	2
Toyota	Prius	2004-	12	0	0
Renault	Megane	2003-	402	13	3
Renault	Scenic	2003-	319	10	3
Renault	Espace	2003-	142	2	1
Saab	9-3	2003-	73	3	4
Volvo	S40	2004-	17	1	6
Volvo	V50	2004-	74	1	1
Volvo	XC90	2002-	54	2	4
VW	Touareg	2003-	64	4	6
VW	Passat	2005-	141	1	1
Total			2684	80	3

DISCUSSION

The seat belt is one of the most important safety devices in a modern car. Even if the belt has saved thousands of lives per year there is a huge potential left. By making all occupants in the cars and trucks wearing their seat belts many thousand lives could be saved also in societies with relatively high seat belt use. Setting the seat belt use target at 100% seems the only logical way ahead.

Seat belt reminders are playing an important role in changing the seat belt use. This study is indicating that more than 80% of the non-wearers of seat belts put their belt on in a car with seat belt reminders.

While seat belts have been found to be very effective for a long time, and several methods have been applied to stimulate and increase seat belt use, there is still a major potential in increasing the use of seat belts to 100%. This also applies to countries with a very high seat belt use, between 90 and 95%. There seems to be a positive marginal benefit, which is associated with that those not using seat belts are also more likely to be involved in crashes, especially in serious crashes. On the other hand, there is little, if any, resistance to use

seat belts in countries where this issue has been researched. The modern seat belt reminders have been developed with this in mind, i.e. the force that is applied to the driver does not need to be in the order of an interlock, but it has to be persistent enough and acting with sufficient time duration.

The results of this study show remarkable results. While the seat belt use for a control group was 85.8 %, the use of seat belts was 97.5 % in the group with the most advanced reminders. While the control group would have had a higher use if the observations were conducted outside built up areas, the use of seat belts for those in a car with SBR would probably not be lower. The results were also consistent in that cars with mild reminders had a significantly higher seat belt use than cars without, and a significantly lower use than cars with SBR according to Euro NCAP protocol. This is also consistent with earlier results Kraftt et al (2005) and Bylund and Björnstig (2001) and might be consistent with studies made in the USA Williams et al (2002).

The case and control car models in this study were selected to be as similar as possible in size and age. However, as often in transition phases, a perfect match is very hard to achieve.

The cars equipped with seat belt reminders are slightly younger than the control cars. It is therefore important to follow the seat belt use in those cars over time. In this study no attempt was made to control for potential differences in driver profiles between the case and control groups. This is an important factor that could change the results if significant differences would occur in driver age, gender or socio-economic status.

The study group with mild reminders included different levels of reminding signals. Volvo S60 and V70 changed during the period 2001 to 2005 where the intensity of the sound signal increased. It was not possible to further study the importance of the light and sound in this study, but it is evident the seat belt use was lower for the mild systems, and for the cars individually that had different, but mild reminders.

A study from Australia within the SafeCar project (Regan et al 2005), where specially equipped cars where SBR was turned on and off in a controlled experiment during a long observational time, and where the cars logged all data, it was found that the proportion of time when the driver or passenger was not using seat belts in speed over 40km/h was reduced from 6% to almost 0. In these cars, the reminder system was designed according to the principles of Euro NCAP.

This study looks at seat belt use in traffic. Previous studies have shown a major difference in seat belt use between normal traffic and serious crashes. It is important to perform studies of seat belt use in crashes also for cars with SBR. Such studies should be possible to conduct at this stage or very soon, as the market penetration of SBR is large.

The results show that SBR is one of the most cost effective measures available. In Sweden approximately 150 unbelted car occupants are killed every year. With a 50% effectiveness of the seat belt in reducing fatalities, approximately 60 lives in Sweden annually (14% of the total number of fatalities) could be saved. On a European level more than 7000 annually could be saved, which supports earlier estimates by ETSC. For a small investment into every new car, the benefit cost ratio (BCR) should be much higher than 1 to 10, based on earlier calculations (Fildes et al 2002).

The results presented in Table 3 raised some concerns about possible disconnection of the SBR for specific car models in some countries. The data is however, too limited to draw any conclusions about it. In the Euro NCAP protocol, one of the requirements is that the system should not be easy to disconnect,

and that if this is possible, that instructions how to do so should not be available in the owners manual. The owner would therefore be forced to contact the dealer or a workshop with a manual for the car. Hopefully, the automotive sector will be very restrictive in disconnecting reminder systems, as they have strong arguments for not doing so. In the present case, the head office of the car importer was contacted, and a message was sent out from the head office to all dealers and workshops to be very restrictive to disconnection of seat belt reminders. Activities, such as the vehicle inspections, should have an important role to prevent disconnection of SBR.

In the present study, taxi cars were not observed. In Sweden, the use of seat belts among taxi drivers is lower than in the rest of the population (79%). While taxis in Sweden normally are cars up to three years of age, most of them today will have a seat belt reminder. It is important to follow such a group. Also front and rear seat occupants should be studied further, as a growing proportion of new cars have seat belt reminders also for front passenger seat and rear seat.

CONCLUSIONS

It was found that the seat belt wearing rate in cars with seat belt reminders that fulfil the Euro NCAP protocol was 97.5 % in the European cities studied, while the rate was 85.8% in cars without reminders.

The results indicate that the number of unbelted car occupants is decreased by 80% independent of the wearing rate.

Smart seat belt reminders are highly effective in increasing seat belt use, and that the results support previous estimates that more than 7000 lives in Europe and 8000 lives in the USA could be saved each year. Therefore actions aimed at increasing the fitment rates of SBRs are desirable.

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APPENDIX

Table 4. Car models included in the study

Car models with SBR			Car models with mild SBR		
Alfa Romeo	159	2005	Saab	9-3	1998-2002
Audi	A3	2005-	Volvo	V70	2001-
Audi	A4	2005-	Volvo	S60	2001-
Audi	A6	2004-	Car models without SBR		
Citroën	C4	2004-	Audi	A2	2000-
Citroën	C5	2005-	Audi	A3	2003-
Ford	C-Max	2005-	Audi	A4	2001-1998-
Ford	Focus II	2004-	Audi	A6	2003
Nissan	Micra	2003-	Citroën	C5	2001-
Peugeot	407	2004-	Citroën	Picasso	2000-1999-
Toyota	Avensis	2003-	Ford	Focus I	2003
Toyota	Prius	2004-	Ford	Mondeo	2001-
Renault	Megane	2003-	Peugeot	307	2001-
Renault	Scenic	2003-	Peugeot	607	2000-1997-
Renault	Espace	2003-	Renault	Scenic	2002
Saab	9-3	2003-	Smart	Fortwo	1999-2000-
Volvo	S40	2004-	Toyota	Prius	2003
Volvo	V50	2004-	Toyota	Yaris	2001-1998-
Volvo	XC90	2002-	VW	Golf	2004-1997-
VW	Touareg	2003-	VW	Passat	2000-2001-
VW	Passat	2005-	VW	Passat	2004
			VW	Polo	2002-