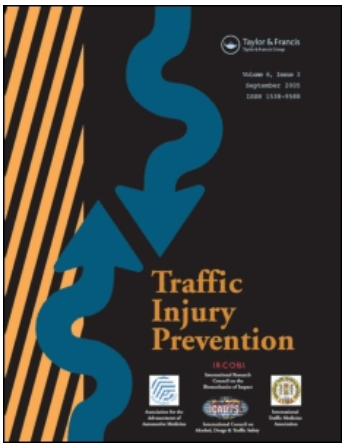

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Intelligent Seat Belt Reminders—Do They Change Driver Seat Belt Use in Europe?

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Objective. *Many modern cars have seat belt reminders (SBRs) using loud and clear sound and light signals. These systems have developed over the last few years. This study investigates how these modern systems influence the seat belt use in real-life traffic in built-up areas in some European cities.*

Methods. *The data were collected by field observations in major cities in six European countries and in five cities around Sweden. A selection of car models having seat belt reminders (SBR) were compared to a fleet of similar car models without such reminders.*

Results. *A significant difference in seat belt wearing rate was found in the cars with seat belt reminders. For all observations, the total seat belt wearing rate was 97.5% +/− 0.5% in cars with SBR, while it was 85.8% +/− 0.8% in cars without. There were differences in seat belt use in the different observation locations. The lowest seat belt use was found in Brussels/Belgium with a use rate of 92.6 +/− 2.2% in cars with seat belt reminders and 69.6 +/− 3.1% in cars not fitted with reminders. The highest seat belt use was found in Paris/France where 99.8 +/− 0.4% of the drivers used the seat belt in cars with reminders and 96.9 +/−1.1% were belted in cars without reminders.*

Conclusion. *Seat belt reminders fulfilling Euro NCAP's seat belt reminder protocol are increasing the seat belt use in daily traffic significantly. Around 80% (82.2% +/− 8.6%) of the drivers not putting the belt on without a seat belt reminder do so in cars equipped with an SBR that has a light signal and an associated loud and clear sound signal.*

Keywords Seat Belt Reminder; Seat Belt Use; Seat Belt

BACKGROUND

It is widely recognized that the seat belt is one of our most important safety inventions. Kahane (2000) estimates the risk reduction associated with seat belts in cars to be 45% in passenger cars and 60% in light trucks. The current wearing rate saves thousands and thousand of lives every year.

Most countries have legislation requiring mandatory use of seat belts. In Europe there is a seat belt use directive. However, seat belt use is not 100% in those countries despite the legislation. The seat belt wearing rate for drivers and front seat passengers in Europe was estimated to be on average 76% in 2003 (ETSC, 2003). For passengers in the rear seat the use rate estimate is 46%. The variations between countries 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 indeed all car passengers were to use the seat belt.

The European Transport Safety Council (ETSC) has previously calculated the potential fatality reductions associated with seat belt reminders. In the European Union (EU-15) another 7600 lives could be saved per year in 1996 if all car occupants used seat belts. In the United States, the potential is also big and it has been shown that another 8000 lives would have been saved if all car occupants used 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).

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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 in increasing seat belt use (Turbell et al., 1996).

Based on the Swedish experience, the European Enhanced Vehicle-Safety Committee (EEVC) initiated work on 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 analyze reasons for non-belt use. In Sweden, Dahlstedt (1999) showed, in a combination of an observational and interview studies, that only a very small fraction (less than 0.1% of the whole population and approximately 1% of the nonusers) was against seat belts as a matter of principle. 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 United States, where it has been reported that only approximately 4% 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, 2004). Ferguson et al. (2006) found that nearly 90% of drivers having cars with seat belt reminders would like one in their next car.

Since 2002 the consumer crash protection program in Europe, Euro NCAP, has rewarded 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 seat passengers. The requirements for the rear seats are lower and do not demand an 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 additional SBR points to 96 cars (Nov. 2006). ETSC has estimated the proportion of new cars sold with seat belt reminders in the 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 the 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 to 2004 and cars with seat belt reminders for 2004 to 2006 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) increases the driver seat belt use in traffic in some European cities.

METHOD

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 would be 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 observations were made in five cities, spread across Sweden (see Table I). In the other six countries observations were only made in one city in each country (see Table I.)

The observation sites in each city were chosen according to traffic density and possibility to conduct the observations. Streets with high traffic density were chosen. The observations were done at traffic signals with the cars standing still or traveling at very low speed. In Paris two different sites were chosen; only one observation site was chosen in the other cities. Generally, five measurements periods (one to two hours) were conducted in each city. However, in Berlin, six periods were used and in Milan, three. The observations were made both in daytime and in the evenings (9 a.m. to 10 p.m.).

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 was being 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.

There are two groups of cars defined:

- The first group contains cars that fulfill the Euro NCAP SBR 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 contained cars without any reminder. The latter group was defined in such a way that it should be similar

Table I 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

in terms of size and age, when compared with the group with reminders.

The cars studied in each category are listed in the Appendix. No control for driver's age, gender, or socio-economic status was performed in this study.

In total 10,237 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). Gauss's approximation for the variance of ratios was used to calculate confidence limits for the effectiveness of SBR.

RESULTS

A significant difference in seat belt wearing rate was found. For all observations, the total seat belt wearing rate was 97.5% +/− 0.5% in cars with SBR, while it was 85.8% +/− 0.8% in cars without. 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 including 95% confidence limits are presented in Table II.

The study indicates that the effectiveness of SBR in terms of increasing the seat belt use for nonusers is in the range of 80% (82.2% +/−8.6%). The effectiveness is a bit lower in Berlin and Brussels but higher in Paris and Sweden.

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 still a huge additional potential saving available. By getting all occupants in the cars and trucks belted, many thousand lives can be saved, even in societies with relatively high observed seat belt use. Setting the seat belt use target at 100% seems the only logical way ahead.

Table II Driver Seat Belt Use in Cars with and Without Seat Belt Reminder Systems, with 95% Confidence Limits

Region	Total n	Belted n	Belt Use %
Belgium/Brussels			
Cars with SBR	526	487	92.6+/−2.2
Cars without SBR	869	605	69.6+/−3.1
Denmark/Copenhagen			
Cars with SBR	326	319	97.9+/−1.6
Cars without SBR	652	580	89.0+/−2.4
France Paris			
Cars with SBR	512	511	99.8+/−0.4
Cars without SBR	897	869	96v9 +/−1.1
Germany/Berlin			
Cars with SBR	446	431	96.6+/−1.7
Cars without SBR	1044	932	89.3+/−1.9
Italy/Milan			
Cars with SBR	463	452	97.6+/−1.4
Cars without SBR	894	770	86.1+/−2.3
Spain/Barcelona			
Cars with SBR	491	484	98.6+/−1.0
Cars without SBR	757	690	91.1+/−2.0
Sweden/5 Cities			
Cars with SBR	734	726	98.9+/−1.1
Cars without SBR	1626	1339	82.3+/−1.9
Total			
Cars with SBR	3498	3410	97.5+/−0.5
Cars without SBR	6739	5785	85.8+/−0.8

The results of this study show remarkable results. While the seat belt use for a control group was 85.8% +/− 0.5%, the use of seat belts was 97.5% +/− 0.5% in the group with 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.

Seat belt reminders are playing an important role in changing the pattern of seat belt use. This study is indicating that more than 80% of the non-seat-belt wearers put their belt on in a car with seat belt reminders. This indicates that the approach used in Europe by Euro NCAP is working. Euro NCAP is promoting systems with a clear visual signal accompanied by a loud and clear acoustic signal. Despite the case and control car models in this study being selected to be as similar as possible in size and age, systematic differences may still occur between the case and control cars.

This study has been performed over a short period of time and results would be expected to change over time as SBRs penetrate further into the fleet and the users potentially change their beat belt use patterns. Over the last few years an increase in seat belt use has been seen in Sweden. To some extent this can be explained by a higher penetration of car models with seat belt reminders. In December 2006, almost 80% of the new cars sold in Sweden had seat belt reminders, fulfilling Euro NCAP's demands (SRA, 2007).

This study looks at seat belt use in traffic. Previous studies have shown a major difference in rates of seat belt use between traffic and serious crashes. It is important to perform studies of actual seat belt use in crashes for cars with SBR. As the market penetration of SBR is large, it should be possible to conduct such studies in the near future.

CONCLUSIONS

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

It can be concluded that smart seat belt reminders are highly effective in increasing seat belt use (82.2% +/− 8.6%), and that the results could mean that many lives could be saved each year if all cars were equipped with SBRs.

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APPENDIX

Car models

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