

Synthesis title:

Seat Belts

Category: Vehicles



Other Relevant Topics:

- ▶ Child Restraints (Vehicles)
- ▶ Advanced Vehicle Systems (Vehicles)

Keywords:

Seat belt,
Lap belt,
Three-point belts,
Lap and shoulder
belts

About the Road Safety Observatory

The Road Safety Observatory aims to provide free and easy access to independent road safety research and information for anyone working in road safety and for members of the public. It provides summaries and reviews of research on a wide range of road safety issues, along with links to original road safety research reports.

The Road Safety Observatory was created as consultations with relevant parties uncovered a strong demand for easier access to road safety research and information in a format that can be understood by both the public and professionals. This is important for identifying the casualty reduction benefits of different interventions, covering engineering programmes on infrastructure and vehicles, educational material, enforcement and the development of new policy measures.

The Road Safety Observatory was designed and developed by an Independent Programme Board consisting of key road safety organisations, including:

- ▶ Department for Transport
- ▶ The Royal Society for the Prevention of Accidents (RoSPA)
- ▶ Road Safety GB
- ▶ Parliamentary Advisory Council for Transport Safety (PACTS)
- ▶ RoadSafe
- ▶ RAC Foundation

By bringing together many of the key road safety governmental and non-governmental organisations, the Observatory hopes to provide one coherent view of key road safety evidence.

The Observatory originally existed as a standalone website, but is now an information hub on the RoSPA website which we hope makes it easy for anyone to access comprehensive reviews of road safety topics.

All of the research reviews produced for the original Road Safety Observatory were submitted to an Evidence Review Panel (which was independent of the programme Board), which reviewed and approved all the research material before it was published to ensure that the Key Facts, Summaries and Research Findings truly reflected the messages in underlying research, including where there may have been contradictions. The Panel also ensured that the papers were free from bias and independent of Government policies or the policies of the individual organisations on the Programme Board.

The Programme Board is not liable for the content of these reviews. The reviews are intended to be free from bias and independent of Government policies and the policies of the individual organisations on the Programme Board. Therefore, they may not always represent the views of all the individual organisations that comprise the Programme Board.

Please be aware that the Road Safety Observatory is not currently being updated; the research and information you will read throughout this paper has not been updated since 2017. If you have any enquiries about the Road Safety Observatory or road safety in general, please contact help@rospa.com or call **0121 248 2000**.

How do I use this paper?

This paper consists of an extensive evidence review of key research and information around a key road safety topic. The paper is split into sections to make it easy to find the level of detail you require. The sections are as follows:

Key Facts	A small number of bullet points providing the key facts about the topic, extracted from the findings of the full research review.
Summary	A short discussion of the key aspects of the topic to be aware of, research findings from the review, and how any pertinent issues can be tackled.
Methodology	A description of how the review was put together, including the dates during which the research was compiled, the search terms used to find relevant research papers, and the selection criteria used.
Key Statistics	A range of the most important figures surrounding the topic.
Research Findings	A large number of summaries of key research findings, split into relevant subtopics.
References	A list of all the research reports on which the review has been based. It includes the title, author(s), date, methodology, objectives and key findings of each report, plus a hyperlink to the report itself on its external website.

The programme board would like to extend its warm thanks and appreciation to the many people who contributed to the development of the project, including the individuals and organisations who participated in the initial consultations in 2010.

SEAT BELTS: KEY FACTS

- Seat belts are designed to retain people in their seats during a crash, the belt is designed to limit the movement of the occupant whilst managing the energy transmitted to the occupant so as to mitigate the likelihood of serious or fatal injury. Within modern vehicles they are designed to work as part the wider occupant restraint system that includes airbags, seats, head restraints and the vehicle structure.
- Early research found that seat belts alone could reduce the risk of injury for drivers by 57% at lower speeds and 48% at higher speeds, and reduced the risk of injury for all occupants by 63% at lower speeds and 55% at higher speeds.
- Recent research found they are 50% effective at preventing fatal injuries for drivers, 45% effective at preventing serious injuries and 25% effective at preventing minor injuries was 25%. For front seat passengers, seat belts are 45% effective at preventing fatal injuries or serious injuries, and 20% effective at preventing minor injuries.
- Rear seat belts were less effective, being 25% effective at preventing fatal injuries, 25% effective at preventing serious injuries, and 20% effective at preventing minor injuries.
- Lap belts are less effective than three point belts, but nevertheless provide significant levels of protection, reducing fatal injuries by 32%.

Seat Belt Use in Great Britain

- The law requiring drivers and front seat passengers in cars and light vans to wear a seat belt was introduced on 31 January 1983. Before the introduction of this law, 40% of drivers and front seat passengers wore seat belts. This increased to 95% immediately following its introduction.
- There was an immediate 25% reduction in driver fatalities and a 29% reduction in fatal injuries among front seat passengers. It was estimated that the seat belt law saved the lives of 241 drivers and 147 front passengers in 1983 and 270 drivers and 181 front passengers in 1984.
- In Great Britain, almost all (95%) car drivers and front seat passengers wear seat belts, and 89% of rear passengers wear seat belts or use child car restraints. However, seat belt use is lower in other vehicles, where only 69% of drivers and front seat passengers wear seat belts. Adult males are less likely than females to wear seatbelts in all seating positions.

- Promoting the positive benefits of seatbelt use is likely to be more effective than focusing on the negative risks of not wearing a seatbelt. Non-users need to develop habit-forming strategies to encourage resilient seatbelt wearing.
- Highly visible seatbelt law enforcement results in an increased perceived risk of being subject to a penalty such as a fine or points on a driving licence and helps to promote improved seatbelt wearing rates.
- Seat belt reminder (SBR) systems can significantly increase seat belt wearing rates. A cross European study found that wearing rates were 97.5% in vehicles fitted with SBR and 85.5% in vehicles without. A study in the USA found that there were 2% fewer driver fatalities in vehicles fitted with SBR, after accounting for differences in vehicle age between cars with and without SBR.

SEAT BELTS: SUMMARY

- Seat belts are designed to retain people in their seats during a crash, and so prevent or reduce injuries.
- Safety belts form a fundamental part of the occupant protection system in all modern motor vehicles.

The Effectiveness of Seat Belts

- The earliest major study of seat belts, in Sweden in the 1960s, found that they reduced the risk of injuries for drivers by 57% at lower speeds and 48% at higher speeds, compared to unbelted drivers. Seatbelts also reduced the risk of injuries for all occupants by 63% at lower speeds to 55% at higher speeds.
- USA studies in the 1960s and 1970s produced various estimates of the effectiveness of seat belts, including:
 - Car occupants using a lap belt had a 73% lower fatality rate, a 53% lower serious injury rate, and a 38% lower injury rate than unrestrained occupants.
 - Users of three point belts had a 60% lower serious injury rate and 41% lower rate of all injuries compared with unrestrained occupants.
 - Users of three point belts had a 56.5% lower injury rate than unbelted occupants.
- In the 1980s, three point seat belts were estimated to be 40% to 50% effective at preventing fatal injuries, 45% to 55% effective at preventing serious injuries and 10% effective at preventing slight injuries.
- In 2000, the USA estimated that seat belts reduced the number of fatalities in passenger cars by 45% and in light trucks by 60%.
- Another USA study suggested that around 60% of fatally injured unbelted occupants would have survived if they had been wearing their seat belt.
- A meta-analysis of 29 studies of seat belt use in 2009 found that:
 - For drivers of cars and vans, seat belts were found to be 50% effective at preventing fatal injuries, 45% effective at preventing serious injuries and 25% effective at preventing minor injuries.
 - For front seat passengers, seat belts were found to be 45% effective at preventing fatal injuries, 45% effective at preventing serious injuries, and 20% effective at preventing minor injuries.
 - For rear seat passengers rear seat belts were found to be less effective, being 25% effective at preventing fatal injuries, 25% effective at preventing serious injuries, and 20% effective at preventing minor injuries.

Seat Belts in Great Britain

- The first major UK studies were published in the late 1970s, and found that seat belts when worn reduced severe or life threatening injuries by 44% and 'moderate' injuries by 44%.
- The law requiring drivers and adult front seat passengers in cars and light vans to wear a seat belt was introduced in Great Britain on the 31st January 1983. In 1989, it became compulsory for rear seat passengers under 14 years old to use seat belts, if fitted, or an appropriate child restraint if available. In 1991, it became compulsory for adult passengers to wear seat belts in the rear if seat belts are fitted.
- Before the introduction of the law in 1983, around 40% of drivers and front seat passengers wore seat belts. This increased to around 95% immediately following the law's introduction and remained at that level over the course of the year.
- There was a 25% reduction in driver fatalities and a 21% reduction in the number of serious driver injuries in the year following the law's introduction. Slightly larger falls were seen for front seat passengers, for whom there was a 29% reduction in fatal injuries and a 30% reduction in serious injuries.
- It was estimated that the seat belt law saved the lives of 241 drivers and 147 front passengers in 1983 and 270 drivers and 181 front passengers in 1984.
- Other studies found a 20% reduction in the number of drivers, and a 33% reduction in front seat passengers, admitted as in-patients. There was also a 20% reduction of seriously injured drivers and a 16% fall in seriously injured front seat passengers.
- Seat belt use in passenger vehicles in Great Britain is very high. Almost all (95%) of car drivers and front seat passengers wear seat belts. In the rear of cars, 89% of passengers wear seat belts or use child car restraints.
- However, seat belt use is lower in other vehicles where only 69% of drivers and front seat passengers wear seat belts.
- Sixty per cent of road casualties in Great Britain are car occupants. Despite the effectiveness of seat belts, 109,046 people were killed or injured while travelling in cars, in 2016. It is not recorded how many were or were not wearing seat belts. (RRCGB, DfT, 2017)

Types of Impact

- Three point belts in cars are highly effective in head on crashes, reducing fatalities amongst belted occupants by 50%.
- Seatbelts are most effective in reducing fatalities in a rollover accident, in which they reduced the number of deaths by 74%.
- Seatbelts are least effective in side impacts, with a 10% reduction in fatalities from impacts on the same side as the occupant and a 39% reduction in fatalities in far side impacts among belted occupants compared to unbelted occupants.

Lap Belts v Three Point Belts

- Lap belts are less effective than three point belts, but nevertheless provide significant levels of protection.
- In frontal impacts compared to being unrestrained, wearing a lap belt reduces the injury rate by 23% whereas wearing a three point belt reduces the injury rate by 53%.
- In side impacts, compared to being unrestrained, lap belts reduce the injury rate by 40%, whereas three point belts reduce it by 59%.
- Lap belts are estimated to be 57% effective in reducing serious injuries in the rear seats of vehicles.
- Lap belts are estimated to be 32% effective in reducing fatal injuries, compared with when not using a seat belt. Three point belts are estimated to be 44% effective.
- In side impacts lap belts were found to be 48% effective in reducing fatal injuries. Three point belts were found to be 53% effective in reducing fatal injuries.
- Both lap belts and lap and shoulder belts are both very effective in reducing fatal injuries in roll-over accidents, by 76% and 77% respectively.
- A 1999 study found that the fatality rate among people in vehicles fitted with lap belts was higher than those with the three point belt, for all age groups.

Seat Belts fitted to rear seats

- Analysis of USA road casualty data from the mid 1970s to the mid 1980s estimated that rear seatbelts were 18% effective at preventing fatal injuries.
- Their effectiveness at reducing the probability of fatal or serious injury appeared to change over time and one study in 1985 estimated the effectiveness at either 60.7% or 53.4% depending on whether the first or last six months of the year were analysed.

- A 2007 study found that rear seat occupants in a car who wear a seat belt reduce their risk of death in the event of an accident by approximately 60%.

Increasing Seat Belt Use

- 95% of all car drivers observed in England and Scotland were wearing seatbelts, and the proportion of car occupants wearing seatbelts in the rear of a vehicle remains lower than those wearing seatbelts in the front.
- For adult drivers and passengers seatbelt use increases with age, and adult males are less likely than females to wear seatbelts for all seating positions.
- Promoting the positive benefits of seatbelt wearing is likely to be more effective than focusing on the negative risks of not wearing a seatbelt. Non-users need to develop habit-forming strategies to encourage resilient seatbelt wearing behaviour.
- Highly visible seatbelt law enforcement results in increased perceived risk of being caught and improved seatbelt wearing rates.
- Seat belt reminder systems fitted in vehicles increase seat belt wearing rates.

METHODOLOGY

A description of the methodological approach to all of the research reviews on the Road Safety Observatory is available at <http://www.roadsafetyobservatory.com/Introduction/Methods>.

This review was compiled during July to November 2012. The steps taken to produce this review are outlined below:

Identification of relevant research

Searches were carried out on pre-defined research (and data) repositories. Search terms used to identify relevant papers included but were not limited to:

- “Seat belts”
- “Lap belts”
- “Three-point belts”,
- “Lap and shoulder belts”.

A total of 49 pieces of potentially relevant research were identified.

Initial review of research

This primarily involved sorting the research items based on key criteria, to ensure the most relevant and effective items went forward for inclusion in this review. Key criteria included:

- Relevance: whether the research makes a valuable contribution to this synthesis, for example robust findings from a hospital-based study.
- Provenance: whether the research is relevant to drivers, road safety policies or road safety professionals in the UK. If the research did not originate in the UK the author and expert reviewer have applied a sense check to ensure that findings are potentially relevant and transferable to the UK.
- Age: Priority is given to the most up to date titles in the event of over-lap or contradiction, although older research papers are included because much of the fundamental research took place as seat belts were being developed and used.
- Effectiveness: whether the research credibly proves (or disproves) the effectiveness of a particular road safety initiative or intervention.

Following the initial review, 35 pieces of research were taken forward to form the basis for this synthesis, 13 of which were published in the UK.

In December 2017, statistics from Reported Road Casualties Great Britain were updated to [Reported Road Casualties Great Britain 2016](#).

Detailed review of research

Key facts, figures and findings were extracted from the identified research to highlight pertinent road safety issues and interventions.

KEY STATISTICS

Seat belts are designed to retain people in their seats during a crash, and so prevent or reduce injuries. They minimise contact between the occupant and vehicle interior and significantly reduce the risk of being ejected from the vehicle.

On modern vehicles, seat belts are also designed to work as the key part of wider injury prevention measures and safety systems, such as airbags and head restraints, which will not be as effective in reducing the risk of injury if an occupant is not wearing a seat belt.

Car occupants form 60% of all road casualties in Britain. In 2016, 109,046 people were killed or injured while travelling in cars, of these 74,589 (67%) were drivers.

Table 1; Car Occupant Casualties in Great Britain (RRCGB, DfT, 2016)¹

	Driver	Passenger	All Occupants
Killed	552	264	816
Seriously Injured	5,977	2,998	8,975
Slightly Injured	68,060	31,195	99,255
All	74,589	34,457	109,046

In 2011, of the 883 people killed while travelling in cars, 788 were drivers or front seat passengers and 92 were rear seat passengers.

In Great Britain, seat belt wearing rates are very high. Almost all (95%) car drivers and front seat passengers wear seat belts. In the rear of cars, 89% of passengers wear seat belts or use child car restraints. However, seat belt use is lower in other vehicles where only 69% of drivers and front seat passengers wear seat belts.²

Seat Belt Laws in the UK

In the UK drivers and passengers in cars must wear a seat belt, unless they have a medical exemption certificate. Children, with few exceptions, must use an appropriate child restraint, until they are either 12 years old or 135 cm in height, at which point they must use the car's seat belts. It is the driver's legal responsibility to ensure that any passenger under 14 years old is using the appropriate child restraint or an adult seat belt. Passengers 14 years old or over are legally responsible for wearing a seat belt.

Full details of the UK legal requirements for seat belts can be found at <https://www.gov.uk/seat-belts-law/overview>.

¹ "Reported Road Casualties Great Britain 2011, Department for Transport, 2012

² "Seat Belt Wearing Rates: 2009: Survey Results for England and Scotland", Department for Transport, 2010

RESEARCH FINDINGS

The Effectiveness of Seat Belts

The overall effectiveness of a seat belt depends on both the proportion of vehicle occupants who wear seat belts and the ability of the belt working in conjunction with the vehicles safety restraint system to provide a means of mitigating the forces from an impact during a vehicle accident. The effectiveness of the seat belt and its associated restraint system can be measured by the percentage reduction in fatalities or injuries for restrained occupants as compared to those suffered by unrestrained occupants.

Swedish Research on the Effectiveness of Seatbelts

The earliest major study of seat belts was carried out in Sweden in the 1960s. Some studies had been conducted before this, but had been based on samples which were too small, or that they were not representative of all accidents that had occurred when and where the study took place. In addition the wide range of models of vehicle and types of seat belt had meant that it was difficult to compare results between the studies. (Bohlin 1967)

At the time of the study, Volvo guaranteed to repair accidental vehicle damage over a certain price (\$80 at 1967 prices), or replace the vehicle with a new one if it was written off. The author implied that reporting the damage to the company was mandatory to take advantage of this guarantee, but did not describe the process. This resulted in a substantial data set containing a large range of injury severities and relative completeness in reporting accidents.

Accident reports were collected by Volvo using this method between the end of March 1965 and the end of March 1966. A form was given to the drivers to complete after the accident, and so the study relied on self-reported information. During the time period covered by the guarantee, there were 297,000 cars in Sweden. 37,761 accidents were reported, and 28,780 accident forms satisfactorily completed. 28,780 drivers, 8,731 front seat occupants, and 5,302 rear seat occupants were involved in these accidents, 1,803 of which resulted in an injury to one or more of the occupants.

A comparison between belted and unbelted drivers and passengers enabled predictions to be made about the protective effect of the seat belt at different speeds. Looking at non-fatal injuries among belted drivers, the rate of injuries was reduced by 57% at lower speeds and 48% at higher speeds compared to unbelted drivers. There were slightly higher reductions when comparing belted and unbelted occupants where seatbelts were found to have reduced the rate of injuries by 63% at lower speeds to 55% at higher speeds.

Only one belted occupant was fatally injured in this study, and the authors commented that the use of a seat belt was entirely protective against fatal injury at accident speeds of less than 60mph in the sample.

The study also looked at injury due to ejection of the front seat occupant, which happened in 159 of the unbelted cases but in only one of the belted front seat occupants. Although it was difficult to confirm that ejection from the vehicle had caused some of the reported injuries amongst these occupants, the authors cautiously estimated that the risk of a fatal injury is increased by more than 10 times if an occupant is ejected from the vehicle.

US Research on the Effectiveness of Seatbelts in the 1960s and 1970s

Several studies in the USA looked at the effectiveness of seatbelts throughout the 1960s and 70s. The largest study was published in 1974, using injury data collected between late 1971 and early 1972. Data was collected by the police, using a supplemental form on seat belt use which was completed within a few days of the original accident report. This system allowed the collection of in-depth detail over a short period of time without adding a large time and cost burden on the accident investigators. Given this method of data collection, this study only included accidents which were reported to the police. (Kahane 1974)

A total of 40,000 occupants were involved in police reported crashes during the data collection period. 18% were reported as wearing a lap belt and 2% were reported as wearing a three point belt; the other 80% were reported as unrestrained. Separate estimates of effect were calculated for lap and three point belts.

Compared to unrestrained occupants, the occupants using a lap belt had a 73% lower fatality rate and 53% lower serious injury rate. They also had a 38% lower injury rate than the unrestrained occupants.

Users of three point belts had a 60% lower serious injury rate and 41% lower rate of all injuries compared with unrestrained occupant. Out of the 815 occupants who were wearing three point belts, there were no fatal injuries.

The National Highway Transport Safety Authority began the Restraint Systems Evaluation Program (RSEP) to accurately identify the effectiveness of seat belts in 1975. The rationale was that whilst all previous studies had found that seatbelts prevented injuries, there was a wide range of estimates of effect, due to their different methods of collecting information on injuries, variations in which the severity of injury was coded and inaccuracies in the way that data was collected. In calculating the effectiveness of seatbelts, studies had controlled for different confounding variables.

A study was conducted as part of the Restraint Systems Evaluation Program to overcome some of these problems, which used data from 15,000 towaway accidents collected from 5 sites in the USA. Data was collected by specialist accident investigation teams who using an in depth reporting form. (Reinfurt et al 1975)

Data was only taken from towaway accidents as a high proportion are likely to be both reported and recorded. This limits the bias that could occur from over or under reporting of certain types of more minor accidents, which was a criticism of previous USA studies. However, restricting the study to a certain severity of accident means that it is not certain how well the estimates apply to less severe accidents. Data was also restricted to vehicle models produced between 1973 and 1975 to ensure a greater consistency in the design of seatbelt available to occupants. The reliability of the data was assessed by judging its completeness.

During the analysis, the data was stratified for the crash configuration, vehicle damage severity, vehicle weight, and occupant age. Stratification involves splitting the data up into several smaller subgroups based on these categories and calculating an estimate for the effect for seat belts for each group. These estimates can then be combined to work out a more accurate estimate of the overall effectiveness of seat belts.

Following the stratification, the study found that when looking at injuries which were judged to be 'moderate' severity and above, users of three point belts had a 56.5% lower injury rate than unbelted occupants. It also found that belts were more effective at preventing injuries among occupants over 55 years old and that their effectiveness did not differ between different sizes of car.

The effectiveness was calculated for different impact angles, depending on which side of the car was damaged. In frontal impacts compared to being unrestrained, wearing a lap belt reduced the injury rate by 23% and wearing a three point belt reduced the injury rate by 53%.

Seatbelts were also protective in side impacts, and compared to being unrestrained, lap belts reduced the injury rate by 40%, and three point belts reduced the injury rate by 59%.

A review of articles on seat belt use later that year took stock of 19 previous USA studies that had been conducted between 1960 and 1974, and had made a broad range of estimates of effectiveness of seat belts, ranging from 7.5% effective to 85.6% effective. (Robertson 1976)

The variation between the studies was attributed to their different methodologies, as opposed to any variation in the effectiveness of seat belts. Two of the largest potential sources of bias in previous studies were discussed; one was a source of over estimation of effectiveness, and the other a source of underestimation.

Firstly, many of the studies relied on self reported seat belt use, which is a measure of whether it was claimed the seat belts were used rather than whether they were actually used. The author cited studies which found differences between the proportion of drivers who reported using a belt, with the proportion observed using one. In these studies, the observed belt use was lower than claimed use following an accident. Hypothetical data was used to show that if the real effectiveness of seat belts was 40%, the observed effectiveness would be 53% if only 5% of uninjured occupants claimed that they used belts when they did not.

The second source of error was that studies tended to only include crashes where an occupant was injured. This means that crashes where an occupant may have been injured were they not wearing a seatbelt were excluded from the analysis. Using the same hypothetical data, this exclusion meant that the effectiveness at preventing severe injuries would have been calculated at 22.1%, and the effectiveness at preventing all injuries at 23.3%.

UK Studies on the Effectiveness of Seat Belts

The first results from an in-depth UK study on the effectiveness of seat belts were published in 1977 (Sabey et al 1977) and a more detailed analysis was published in 1978 (Hobbs 1978). The data used for both reports was taken from an in-depth study of 1,126 accidents between 1974 and 1976.

Accidents were included if more than one person was injured and attended the local hospital; the hospital data was then matched with police reports on the collisions which included detail of all occupants. In total there were 2,879 vehicle occupants in the sample, including 1,100 who were uninjured.

In order to calculate the effectiveness of seat belts, only information from front seat occupants was used. Of these 490 were wearing belts, 1,163 were not, and in 303 cases seat belt use was not known. Information on the injuries was also collected and coded by severity and location on the body, using a system known as the Abbreviated Injury Scale (AIS).

Of the belted occupants, 42% were uninjured compared with 28% of the unbelted occupants. There was a 45% reduction in severe or life threatening injuries, which were sustained by 107 of the 1,163 unbelted occupants and 25 of the 490 belted occupants. The authors calculated that there was a 95% certainty that the true reduction was between 65% and 13%. There was also a 44% reduction in injuries that were classed as 'moderate' with 261 sustained by the unbelted occupants and 62 by the belted ones. There was a 95% certainty that the true reduction lay between 58% and 42%. There was no significant difference in minor injuries between the two groups.

Head injuries were the most common injury recorded in the sample. There were significantly fewer head injuries coded as AIS 2 or higher (representing all injuries 'more severe than minor') among the belted occupants. The rate of head injuries was 237 per 1,000 unbelted occupants to 106 per 1,000 who were belted. Usually the injury was caused by contact with the steering wheel among belted occupants or contact with the steering wheel and area around the windscreen for unbelted occupants.

The researchers also identified that seat belts prevented the occupant from being ejected from the vehicle, and that just under a quarter of those thrown from the vehicle were fatally injured.

A 1988 in-depth study of road accident casualties used information from casualties presenting to hospital in Oxfordshire in 1983 and 1984. As part of the analysis the effectiveness of seatbelts was examined. (Tunbridge et al 1988)

There were 5 fatal injuries in the 70 occupants who were unbelted, and 16 fatal injuries amongst the 925 who were belted. As this study was conducted following the introduction of the seat belt wearing law, fewer vehicle occupants were recorded as not wearing a seatbelt. The authors did not perform any further analysis with the figures.

USA Estimate of true effectiveness

In 1984, the National Highway Traffic Safety Authority carried out a Final Regulatory Impact Analysis on a series of suggested amendments to the Federal Motor Vehicle Safety Standard which sets the standard for occupant crash protection. This included the largest and most comprehensive study of seat belt effectiveness based on USA data. (NHTSA 1984)

The NHTSA combined three large sources of police reported data analysed previous studies, and consulted on their proposals to get feedback from a large number of stakeholders. Comments received by this method were also used to identify the most accurate estimate of effectiveness.

The study estimated that three point seat belts were 40% to 50% effective at preventing fatal injuries, 45% to 55% effective at preventing serious injuries and 10% effective at preventing slight injuries. Lap belts were less effective than three point belts.

Although the data was not adjusted to control for all of the confounding variables, as the RSEP study had done previously, the NHTSA did assess how overall effectiveness was affected by the accident severity and damage to the vehicle.

It also compared their results against estimates of seat belt effectiveness at preventing fatal injuries in eleven other countries. The average effectiveness for these other countries was 47.1%.

Confirming the estimate of true effectiveness

Other methods and approaches to estimating the effectiveness of seat belts were developed throughout the 1980s and 1990s.

One method known as a 'double pair comparison' was initially used in the 1980s. This uses the ratio of driver to front seat passenger fatalities in crashes where the driver was belted and the passenger unbelted, and the ratio in crashes where both the driver and passenger were unbelted. By comparing the two ratios, one study established the probability of a belted driver or passenger being fatally injured, compared to an unbelted driver or passenger. (Evans 1986)

This method was used to calculate an estimate of front seat belt effectiveness using data from FARS. Vehicles from 1974 onwards were included in the study, as this was the year when USA manufacturers were required to equip vehicles with integrated three point lap and shoulder belt restraint systems. The data set contained information on 15,449 fatally injured drivers and 16,311 fatally injured passengers.

The estimate was that front seat belts were 41% effective. The paper reported the standard error of the estimate as $\pm 3\%$. This is consistent with the NHTSA estimate of 40% to 50%.

The advantage with the double pair comparison method is that an estimate of seat belt effectiveness can be worked out using only information collected about fatal accidents in the Fatal Accident Reporting System (FARS), which is a relatively complete database, so the study is less affected by incomplete reporting of non-fatal injuries.

A further advantage is that by matching the proportion of fatally injured occupants in different seats in the same vehicle, it controls for several potential factors that may be different between the belted and unbelted occupants, such as differences that may exist in the vehicle or collision type, or ambulance response time. This matching enabled some of the observed differences in the likelihood of injury between belted and unbelted occupants to be taken into account.

In 1993 a study used hospital data on non-fatal crashes to assess the effectiveness of seat belts. Data was collected (from November 1987 to November 1988) on everyone receiving medical treatment in one of 16 hospitals in Iowa following a crash. The severity of each injury was recorded, and an overall severity was calculated. (Conn et al 1993)

After excluding people, who had missing data, who were not sitting in the front seats of the vehicle, or were less than 6 years old, there were 893 occupants remaining in the data set suitable for analysis. Of these 445 were recorded as using seat belts at the time of the crash, and 448 were recorded as not doing so. 88 occupants were seriously injured.

The analysis found that before adjusting for confounding factors, the odds of being seriously injured were 4.4 times greater for occupants who were not wearing seat belts.

Explaining Improvements in the Effectiveness of Front Seatbelts Over Time

Several studies have evaluated the effectiveness of seat belts more recently. In 2000, NHTSA refined their estimate on the effectiveness of seat belts based on data from 1986 to 1999. (NHTSA 2000)

The revision was needed because estimates, even when using of identical methods, and data sources seemed to show that seat belts had become more effective. There was also criticism of the double pair comparison method, which relied on two vehicle occupants in order to be estimate the effectiveness of seat belts, whereas, accidents involving single occupants may have different crash characteristics and therefore the seat belt would have a different effectiveness in these crashes and overall.

The best overall effectiveness was calculated to be a 45% reduction in the number of fatalities in passenger cars and 60% reduction in fatalities in light trucks, comparing belted with unbelted occupants. This was a relatively precise estimate although the authors estimated that the true result may be 4% to 10% in either direction.

The study also showed that three point belts in cars were most effective in head on crashes, showing a best estimate of a 50% reduction in fatalities amongst belted occupants. Seatbelts were most effective at preventing fatalities in a rollover accident, showing a best estimate of a 74% reduction in fatal injuries. 69% of the fatalities in rollover accidents were amongst occupants who were ejected from the vehicle.

Seatbelts were least effective in side impacts, with a 10% reduction in fatalities from impacts on the same side as the occupant and a 39% reduction in fatalities in far side impacts among belted occupants compared to unbelted occupants.

A matched pair cohort design was used in a 2003 study of occupants who had been involved in a fatal crash recorded in the FARS database. Again, the use of matching was strength of this method. The authors also investigated why they found that seatbelts were more effective than some of the older studies. (Cummings et al 2003).

The main analysis performed by the authors was based on crashes from 1986 to 1998. Data was excluded when more than 25% of the records for a state within a year were missing information on seat belt use. This was to keep a relatively high standard of data quality. The final sample was based on accidents involving 88,778 cars, and as well as information on seat belt use, injury, occupant age and gender.

The overall estimate for relative risk reduction between belted and unbelted occupants was 0.39, with 95% confidence intervals from 0.37 to 0.41. This means that around 60% of the unbelted occupants would have survived if they had been wearing their seat belt.

This estimate was the same for both genders; however, the estimate for the effectiveness of the seat belt did vary with age. The relative risk for occupants who were 16 to 34 years old was 0.36, showing that a slightly higher proportion of occupants in this age group who were wearing their belt survived. Seatbelts became progressively less effective for each older age band. The oldest age band in the study included occupants who were 70 years or over, and for this group the relative risk was 0.46, indicating that belts were less effective for this age group.

The authors investigated reasons for their estimate showing that seat belts were more effective than previous studies. They found that the difference was not due to differences in the methods of analysis, the effectiveness of seatbelts in modern cars, or changes in crash characteristics over time.

The authors also investigated whether the misclassification of occupants as belted or unbelted could have influenced the changes over time because an improvement in the accuracy of recording seat belt use following laws requiring them to be worn, may have accounted for some of the difference. They found that a consistent low level of misclassification of use against a backdrop of increasing seat belt use could explain the whole apparent change in effectiveness.

Specific estimates of effectiveness in the rear seat

The 'double pair comparison' method used by Evans was used again in 1988 to estimate the effectiveness of rear seat belts at preventing fatal injuries. (Evans 1988) There was more uncertainty in using this method to estimate the effectiveness of seat belts in the rear because the occupancy rate, and seat belt use, were lower in the rear.

FARS data from 1975 and 1985 was used, although occupants under 16 years were excluded from the analysis so that the drivers and passengers would be of a comparable size and age.

The estimated effectiveness of rear seatbelts was 18%. The paper reported the standard error of the estimate was $\pm 9\%$. This estimate applied to occupants in the outboard rear seats, as there were very few central rear seat occupants in the data.

There may be several reasons why this estimate is lower than the front. The authors suggested that many of the vehicles in the study may have been fitted with lap belts in the rear, which would be less effective than the three point seat belts used in the front seats. Restraint use was coded in the FARS data, but restraint type was not, which means it is not possible to calculate separate estimates of effect.

A publication in 1987 used data from 701,763 car occupants involved in accidents reported to the police in Michigan in 1985. The study was carried out because a law requiring seat belts to be worn in the front was passed in Michigan in February 1985 and went into effect from July of the same year. Vehicles built before 1973 and occupants under 5 years old were excluded from the analysis. (Campbell 1987)

The authors highlighted many problems with the quality of the data, such as belt use being overstated among uninjured occupants and the high proportion of males in the uninjured group, due to the convention in Michigan at the time to code uninjured occupants as male if their gender was unknown.

However, their analysis of the injured rear seat occupants found that seat belts in the rear were 26% effective at reducing the probability of fatal or serious injury among injured adult occupants in 1984. There was no estimate of the confidence intervals.

A similar analysis conducted on the data from January to June 1985 and July to December 1985 found that the effectiveness of the seat belt increased to 60.7% and 53.4% respectively, which the authors attributed to bias in the coding of belt use following the introduction of the law.

The USA National Transportation Safety Board carried out a special crash investigation program in 1984 to learn more about the performance of lap belts. The programme set out to investigate 200 crashes which would be examined in depth by The Board's highway field investigators. The investigators arranged to be notified of accidents via local law enforcement and medical authorities. The resulting report of all of the notified accidents that met the selection criteria was a case series of 26 frontal crashes published in 1986 (NTSB 1986).

The NTRB stated that the small sample size meant that no statistically valid conclusions could be drawn from it. In addition, it is not known how representative the crashes that NTRB investigated were of all crashes and without this there is a risk that there is significant selection bias in the sample, leading to the wrong conclusion being drawn about the relative effectiveness of different restraint systems.

139 occupants were included in the case series, of whom 57 were unrestrained, including 4 who were fatally injured. One of 32 occupants who were using the three point belt, and 13 of the 50 occupants who were using lap belts, were fatally injured. The report argued that amongst the 50 people using a lap belt, 32 of them would have fared substantially better if they had been wearing a three point belt.

A study in 1989 examined the effectiveness of seat belts at preventing fatal and serious injuries in the front and the rear seat (Maghsoodloo et al 1989).

It used routine data collected by the police in Alabama between 1984 and 1987. Occupants who had to be carried away from the scene of the accident were categorised as seriously injured in this study. A strength of this study was the use of a new reporting form which allowed accident investigators to record information for occupants who were not injured in the crash.

There were 1,097,220 occupants recorded, of which there were 132,162 injuries or deaths. The majority of occupants were either drivers (708,111) or front seat passengers (245,622).

Again, the majority of rear seat passengers used lap belts. Their effectiveness at preventing fatalities was estimated at 8%, with no confidence intervals provided in the paper. During this period, the police recorded very low numbers of fatally injured restrained passengers in the rear. The lap belts were estimated to be 57% effective at preventing serious injuries in the rear.

A 1999 NHTSA study, based on data from FARS collected between the start of 1988 and the first six months of 1997, examined the effectiveness of the different types of seat belt in the outboard rear seats in a range of crashes. The methodology used was a matched double pair comparison, and the fatality risk calculated was the ratio of fatalities in the back seat to fatalities in the front seat. The fatality risks were compared for the different restraint systems in the rear in order to estimate the difference in effectiveness. (NHTSA 1999)

The overall estimate of effectiveness was that lap belts are 32% effective in reducing fatal injuries, compared with not using a seat belt, with a 95% likelihood that the true value was between 23% and 40%. Three point belts were probably more effective at preventing fatal injuries, and were found to be 44% effective. There was a 95% likelihood that the true effectiveness lay between 38 and 50%.

The study found no major benefit of lap belts in preventing fatal injuries in frontal crashes, compared to unrestrained occupants. The three point belt was found to be 29% effective in reducing fatalities, however, when compared to unrestrained occupants. The 95% confidence interval ranged from 15% to 42%.

Lap belts did provide protection in side impacts, and were found to be 48% effective at preventing fatal injuries. Three point belts performed better and were 53% effective at preventing fatal injuries. The author reported that the lap and shoulder belts give about the same protection in a side impact, although did not give the confidence intervals for these estimates.

Lap and lap and shoulder belts were both very effective at preventing a fatal injury in a roll-over accident, and were 76% and 77% effective respectively. A confidence interval was not provided.

With the increased installation of three point belts in the rear of cars in the USA, other authors also compared the effectiveness of a three point belt with a lap belt in the rear. A brief study was conducted in 1999 to compare the effectiveness of the two, by comparing fatality rates in vehicles with the different systems fitted. (Robertson 1999).

The FARS database, which provided an accurate number of occupants killed in crashes was combined with the CDS database which has records of all crashes in the USA where a vehicle was towed away. Combining the two databases allowed the calculation of the number of fatalities per crash for different age groups and vehicle weights. The study found that the fatality rate among people in vehicles fitted with lap belts was higher than those with the three point belt. This relationship held for each age group investigated. Differences in the fatality rate for age group and vehicle weight meant that an overall estimate was not calculated.

A 2007 study used a matched cohort design to estimate the effectiveness of rear seat belts. Data for vehicle crashes during 2000 to 2004 was taken from the Fatality Analysis Reporting System in the USA. The risk of fatality whilst wearing a seat belt was compared against the risk of a fatality while not (Zhu et al 2007).

Due to differences between the groups who wore and did not wear the seat belt, an adjusted relative risk was calculated, which helped to correct for the influence of these confounding factors. The relative risk was adjusted for the occupant's age, gender, seating position and airbag. The authors also adjusted for two way and three way interactions between several of the variables. The results of the study were that rear seat car occupants who wear a seat belt reduce their risk of death by approximately 60%.

Current best estimates of seat belt effectiveness

The strongest way of estimating the effectiveness of seat belts can be found by searching for and combining previous estimates to create a larger sample size.

A meta-analysis of 29 studies of seat belt use was published in 2009 (Elvik et al 2009). This is a method which combines the results from the studies to get a best estimate of effectiveness. It found that seatbelts were effective at preventing injury, and were more effective at preventing more severe injuries.

For drivers of cars and vans, the best estimate was that seat belts were 50% effective at preventing fatal injuries, with a 95% chance that the effectiveness was between 55% and 45%. Seat belts were 45% effective at preventing serious injuries, with a 95% chance that the true effectiveness was between 50% and 40%. The best estimate for the effectiveness of seatbelts at preventing minor injuries was 25%, with a 95% chance that the true result was between 30% and 20%.

For front seat passengers, the best estimate was that seat belts were 45% effective at preventing fatal injuries, with a 95% chance that the effectiveness was between 55% and 35%. Seat belts were 45% effective at preventing serious injuries, similar to the front, although there was a wider range of estimates as there was a 95% chance that the true effectiveness was between 60% and 30%. The best estimate for the effectiveness of seatbelts at preventing minor injuries was 20%, with a 95% chance that the true result was between 25% and 15%.

Seat belts were found to be less effective at preventing injuries in the rear seats. The best estimate was that seat belts were 25% effective at preventing fatal injuries, with a 95% chance that the effectiveness was between 35% and 15%. Seat belts were 25% effective at preventing serious injuries, with a 95% chance that the true effectiveness was between 40% and 10%. The best estimate for the effectiveness of seatbelts at preventing minor injuries was 20%, with a 95% chance that the true result lay between 35% and 5%. The wider confidence intervals are due to the lower numbers of people who were involved in the studies. The analysis seemed to combine studies which evaluated the effectiveness of both lap and three point belts in these estimates.

Studies on the effectiveness of seat belt legislation in Great Britain

Compulsory wearing of seat belts by front seat occupants of cars and light vans was introduced in Great Britain on the 31st January 1983.

A report published in 1985 looked at the effects of the law in the first year after it was introduced by assessing the proportion of occupants who were wearing seatbelts and the number of driver casualties from February 1982 to January 1984, giving a one year period either side of the introduction of the law. (Scott and Willis 1985)

This study reported wearing rates data which was collected by roadside observation at 50 sites. Observations were made between 8.30am and 10pm, although because the latter part of this time period is in darkness most of the year, the reported wearing rates were between 8.30am and 5pm.

Before the introduction of the law, around 40% of drivers and front seat passengers were wearing seat belts. This was consistently observed every month with no seasonal trends, although there was a slight rise in the observed rate to 50% in January 1983. The percentage of drivers and front seat occupants wearing seat belts increased to around 95% in February 1983 and remained at this level over the course of the year.

The study found large reductions in car driver and front seat passenger casualties collected in the police STATS 19 data the full year after the seat belt law was introduced, compared with the year before. There was a 25% reduction in driver fatalities and a 21% reduction in the number of serious injuries. Similar, slightly larger, falls were seen for front seat passengers, for whom there was a 29% reduction in fatal injuries and a 30% reduction in serious injuries. Both of these findings were statistically significant. There were smaller but still statistically significant falls in the number of slight injuries.

An analysis was conducted to see if there was any difference between built up and non-built up areas, the time of day, and single and multiple vehicle accidents. No large differences were found and the trend was towards large reductions in casualties in all of these scenarios.

The authors found no large or significant increase in rear seat passenger casualties as a result of front seat passengers moving into the rear to avoid using a seat belt.

The report found no evidence that other road users - such as pedestrians, cyclists or motorcyclists – were more at risk of injury following the introduction of the law, and the authors reported that changes to the number of casualties in these groups was small and statistically insignificant.

Two significant studies about the effect of the seatbelt law were published in 1985.

A study published by the Department of Health and Social Security recruited patients who had been involved in a traffic accident arriving in one of 15 hospitals. (Rutherford et al 1985) The consultants in charge of the Accident & Emergency Department at 20 hospitals were initially contacted with 15 agreeing to take part in the study. The hospitals were spread out across the UK, and were selected so that a high quality of data collection could be maintained during the study period. One hospital went through a major restructure during the project, which changed the data collection process, so data from this hospital was omitted. Data was collected over a one year period before and after the introduction of the seat belt law.

Casualties who met pre-specified criteria were included in the analysis, and a 22 item data collection form was produced for the study. A description of the injuries sustained by each casualty was written on the form and the severity, location and type was coded at a later stage using the AIS scale. Data was checked for incorrect coding and errors were resolved.

Before the analysis was conducted, 17 hypotheses were established based on previous studies. Establishing what would be investigated before the analysis was conducted was a strength of the study as it reduced the likelihood of finding significant effects by chance, due to conducting a large number of tests on the data.

There was a large reduction in serious injuries amongst front seat occupants, which fell from 1,669 the year before the law was introduced to 1,298 the year after, a 22% decrease, which the authors commented was close to the national figure of a 24% reduction. There was little change in the number of rear seat occupants who were seriously injured, as there were 286 in the year before the law and 290 the year after.

The authors also conducted a study of fatalities, based on eight coroner's districts in England. Car occupant deaths between 1st April and 30th September in the years before and after the introduction of the seat belt law were included in the study.

There were 101 deaths from injuries to car occupants in the eight districts in the year before the study, and 75 in the year after, a fall of 25.7%. Looking at the injuries sustained by occupants, the authors concluded that the reduction in injuries to the head, chest, and abdomen were responsible for this reduction.

The authors commented that there was a 2% to 9% increase in the amount of traffic and no major differences in the weather between the two years.

The second study from 1985 was published by the Department of Transport and was commissioned to examine the statistical evidence on the effect of the seat belt law on road casualties. (Durbin and Harvey 1985)

The main data set examined was made up of monthly casualty figures dating from January 1969 to December 1984. Due to an imprecise definition of 'slightly injured' the authors chose to only include serious and fatal injuries in the analysis. The authors divided the casualty figures into nine different categories of road user, including car drivers, front seat passengers and rear seat passengers.

Several categories of other road users were included, such as pedestrians and cyclists, as the authors wanted to investigate whether drivers compensate for the extra safety provided by seat belts by driving in a more dangerous manner.

The authors carried out a time series analysis, which examined the overall trend, the seasonal variations each calendar year and any other irregular components which had influenced the pattern. A computer model was used, which also included allowances for the effects of traffic density and petrol prices on road casualties.

With this approach, a predictive model for each series was developed that fitted the trends in road user casualties before the seat belt law was introduced. The model was then used to measure the change in the level of casualties following the introduction of the seat belt law.

The authors found a reduction in the number of drivers killed or seriously injured of between 20% to 26%. This represents the 50% confidence limits, indicating that there is a 50% likelihood that the true value is within these limits. A similar calculation was conducted for the number of car drivers killed, and the best estimate was that the law had reduced the number of driver deaths by 18%, with 50% confidence limits ranging from 14% to 22%.

There was a 2.9% rise in the number of rear seat occupants who were killed or seriously injured, however this was not a statistically significant finding and may have been due to chance.

Based on the model, the authors predicted that the seat belt law saved the lives of 241 drivers in 1983 and 270 in 1984. Similar estimates were made for front seat passengers, where an estimated 147 lives were saved in 1983 and 181 in 1984.

The authors commented on a 7.8% increase in pedestrian deaths compared with what the model would have predicted. However, they suggested that this was due to the annual reductions in the number of pedestrian deaths not being as large as in recent years, rather than being due to the seat belt law.

They noted that 1984 had the lowest number of pedestrian deaths than any other year in their data and that the number of pedestrians killed or seriously injured showed no apparent increase.

The model also found that there was a 4.8% increase in the number of cyclists killed or seriously injured following the introduction of the law. However, this was not a statistically significant finding and may have been due to chance. The comparatively low numbers of cyclists killed or seriously injured in each month means that small differences in the numbers can lead to large percentage changes. Similarly, the model could not be modified to incorporate data on weather, which influences cycle use.

A study into the long term effects of seat belt wearing was published in 1989. This was intended as a follow up to the study by Rutherford et al and investigated the validity of some questions which that study did not address. This new study included data over a six year period between 1980 and 1985. (Tunbridge 1989)

Data from hospital inpatient records collected in a system called Scottish Hospital Inpatient Statistics (SHIPS) was linked with the STATS 19 records collected by the police using common variables between the two data sets, such as the date and time of accident, location, age, sex and type of road user. As there may have been discrepancies in the information recorded for the same case in the two sets, some tolerances were allowed to account for this.

Around 70% of records from the SHIPS records were matched with the equivalent data from STATS 19 records, to the pre-specified degree of tolerance. This was consistent for every year of data.

The study found many of the same associations as the previous study by Rutherford. There was a 20% reduction in the number of drivers admitted as in-patients in 1983-85: there were 3,804 injuries compared with 4,768 in 1980-82. There was a larger fall in the number of front seat passengers admitted as an in-patient: 1,599 injuries in 1983-85 compared with 2,396 injuries in 1980-82. This was a reduction of 33%. Both of these falls were statistically significant.

There was a reduction of all serious injuries in 1983-5 compared with 1980-82. There were 787 drivers admitted to hospital with serious injuries in 1980-82 compared with 633 in 1985-86, a 20% reduction. A similar fall was seen for severe injuries to front seat passengers with 16% fewer being admitted to hospital: a fall of 356 to 298 between the two time periods.

The study found significant reductions in the already relatively low number of serious injuries to the head, such as skull or facial fractures. There was an increase in sprained necks and fractured sterna following the introduction of the law, although compared to the number of injuries prevented the increase was extremely small.

The authors also investigated whether there had been any changes to the number of casualties amongst non-car occupants. This was performed as a follow up to the previous publication by Durbin and Harvey, which had suggested that there were modest non-significant increases in the number of vulnerable road users following the seat belt laws, but that further research was required based on hospital data.

Based on analysis of the new linked data set, the authors found that there was a 2% reduction in the number of pedestrian casualties; there were 5,478 in 1980-82 and 5,357 in 1983-85. This fall was not statistically significant. There was a slight increase in pedal cycle casualties from 807 to 837 between the two time periods, although this was also not statistically significant. The authors also looked at pedestrian and cyclist casualties from accidents involving cars, and again found no significant change in the numbers between the two time periods.

Increasing Seatbelt Wearing Rates

Seatbelt wearing rates

The latest survey of observed seatbelt usage in Great Britain was conducted in autumn 2009, and found that 95% of car drivers observed in England and Scotland were wearing seatbelts. The proportion of front seat passengers wearing seatbelts or child restraints was 95% in England, and 97% in Scotland. The proportion of rear seat passengers wearing seatbelts or child restraints remained lower at 89% in England, and 88% in Scotland. (DfT 2010) However, one survey in Scotland reported rear-seat passenger wearing rates as low as 48%. (Burns et al, 2002)

For adult drivers and front seat passengers, seatbelt use increases with age (DfT 2010, Burns et al 2002)

For all seating positions and all age groups, males are less likely than females to wear seatbelts (Begg and Langley 2000, DfT, 2010). In Scotland, in the 17-29 years age group, males were 7% less likely to wear a seatbelt than females. (Burns et al, 2002) Another study reported that males had more reported seatbelt offences for all seating positions than women. (Christmas et al, 2008)

Attitudes to wearing a seatbelt

Evaluation of the Think! 'Three Strikes' seatbelt campaign (BMRB, 2009) reports differences in attitudes towards wearing a seatbelt in the front compared with the rear of a car. 70% of all adults completely agreed it was dangerous not to use a seatbelt in the front of a car. Whereas only 63% completely agreed it was dangerous not to use a seatbelt in the rear. Thus suggesting a relationship between attitude toward seatbelts and seatbelt usage

The Department for Transport 's Think! Annual survey carried out in November 2011, supports the 'Three Strikes' evaluation results with 10% fewer adults agreeing that not wearing a seat belt in the back of a car is dangerous, compared to not wearing a seatbelt in the front of a car. (TNS-BMRB 2012)

Interviews with people who had been stopped by the police for not wearing seatbelts found that non-wearing behaviour was excused at least in part because of perceived positive reasons for *not* wearing a seatbelt. These reasons were categorised as: inconvenience, physical discomfort, and ‘emotional discomfort’ such as the feeling of being trapped. (Christmas et al, DfT, 2008)

As well as perceived positive reasons *not* to wear a seatbelt, other explanations of non-use referred to a *lack* of “compelling” reasons to do so. For example interviewees reported that they feel safer in the back of a car or in a van and therefore do not need to wear a seatbelt in these circumstances. Also if a vehicle had airbags fitted, or if they were only going on a short journey, the respondents perceived that there was no real need to wear a seatbelt. (DfT, 2008)

A study of rear seat belt wearing in Malaysia found that higher knowledge of the benefit of wearing a rear seat belt, plus having a positive attitude toward seat belt wearing, were statistically significant “enablers” of rear seat belt wearing (likely to lead to an individual changing their behaviour). Addressing poor attitudes towards seatbelt wearing was suggested to have greater influence on seatbelt usage than knowledge of the benefits. (Mohamed et al, 2011)

A survey of 79 American university students who were licensed drivers found that in 12 different driving situations (for example, short or long trips, day or night) attitudes toward wearing a seatbelt were significantly positively correlated with intention to wear. (Stasson and Fishbein, 1990)

Christmas et al (DfT, 2008) found no research studies which could recommend ways of changing negative attitudes towards seatbelt use. Seatbelt awareness training courses were cited as a potentially good mechanism to improve attitudes.

Perceived risk

A survey of 948, 21 year olds in New Zealand found that male front seat belt users were significantly less likely than non-users to drive after drinking alcohol or marijuana, to take deliberate risks when driving, or to have been disqualified from driving. Among rear seat belt users and non-users, males who did *not* use a seatbelt were almost twice as likely to drive after drinking as those who did use a rear seatbelt. (Begg and Langley, 2000)

Supporting Begg and Langley’s findings, the DfT report (2008) ‘Strapping Yarns’ also reported that car occupants who take deliberate risks or who display illegal behaviours are less likely to wear a seatbelt than more compliant drivers. These findings suggest that people who are more risk averse are more likely to wear a seatbelt and that there is therefore a relationship between risk perception and seatbelt use.

Stasson and Fishbein (1990) however, cite research showing little direct relation between perceived risk and seatbelt use. They claim that intention to wear a seatbelt predicts actual seatbelt use.

Under the behavioural theories of Planned Behaviour and Reasoned Action intentions are partly influenced by a person's attitude towards that behaviour, and perceived social pressure (social norms). In the theory of reasoned action, perceived risk would influence intentions, and therefore behaviour, *via* attitudes toward wearing seatbelts and social norms.

Stasson and Fishbein hypothesised that attitudes toward wearing seatbelts are held constant across different driving situations (e.g. perceived discomfort or feelings of being trapped). Attitudes may change however based on the levels of perceived risk of accident (long journeys or icy roads for example). This change in attitude may account for variability in seatbelt use.

They, therefore, asked adults to consider driving in 12 different conditions, and asked them a series of questions using seven point scales. The measure of attitude was defined by responses to questions about how much they found seatbelt wearing 'pleasant', and how much they 'liked' and 'enjoyed' wearing a seatbelt in the different situations.

Results showed highly significant positive correlations between attitude and intention, and social norms and intention, but the correlation between perceived risk of accident and intention to wear a seatbelt was not significant. There was a significant correlation however between perceived risk and intention to wear a seatbelt for two "risky" driving situations (e.g. long trips on wet roads at night).

They concluded that use of a seatbelt in any situation depends on one's own attitude toward wearing a seatbelt, and social norms, but not on the level of perceived accident risk. Perceived risk has a smaller and an indirect effect on intentions to use a seatbelt via social norms. In riskier driving conditions, they suggested that people perceive greater social pressure to wear seatbelts than in situations perceived as less risky. This might explain low seatbelt usage rates in the backseat. They concluded that seatbelt wearing can be increased by improving people's attitudes towards seatbelt wearing and by trying to change social norms of important others concerning seatbelt use. Interventions designed to increase people's perception of risk when not wearing a seatbelt they believed to have little effect.

A study that employed the Health Action Process Model stated that people do not always follow their intentions, however well formed, because they, for example, may give into temptation or come across unpredicted barriers. This study suggested that strategic planning and recovery self-efficacy (ie, a person's ability to recover from failures in implementing their intended behaviour) are better predictors of behaviour than intentions, and are, in fact, the "best" predictors. (Schwarzer et al 2007)

For example, if a person intends to always wear their seatbelt but fails to do so, e.g. if they have to be a passenger for a week with someone who doesn't believe in wearing seatbelts, then their ability to 'recover' by going back to intending to always wear their seatbelt is a key predictor of whether or not they will actually do so.

This study claimed that strategic planning “bridges the gap”, between good intentions and actual behaviour. If a person has a strategy for how they are going to implement their intentions – when, where and how they are going to make sure they always wear their seatbelt for instance, then they are more likely to be successful.

The authors tested their theory with a sample of 298 students in Poland. They found that 42% of the variance in seatbelt use (sometimes wear, sometimes don't) was explained by both recovery self-efficacy and planning. These two most immediate predictors of behaviour could account for differences in performing four different kinds of health behaviour (seatbelt use, dietary behaviour, dental flossing and physical activity).

Supporting Stasson and Fishbein's (1990) findings, Schwarzer et al (2007) reported that risk perception was not significantly related to any of the four preventive health behaviours. They suggested that increasing a person's risk perception is not in itself sufficient for promoting behaviour change, and instead recommended making people aware of the skills and strategies they can employ to both implement their intended behaviour change and to recover from setbacks.

The Think! 'Three Strikes' media campaign in 2008 focussed on the physics of a crash. The campaign was aimed at increasing people's perceptions of the risk of not wearing a seatbelt in all driving situations. Although the campaign was well remembered there were mixed results for changes in attitude and behaviour from before to after the campaign. Although there were some positive changes, negative shifts in both attitudes and behaviour were reported.

These negative shifts in behaviour and attitude were despite a reported increase in the perceived risks of not wearing a seatbelt. Nearly 2000 adults were sampled and for all adults (when prompted) there was an increase of 8% who thought serious injury was a very likely consequence of not wearing a seatbelt. Similarly, there was an increase of 6% for all adults who thought death was a very likely consequence. This again provides support for the argument that perceived risk of injury has little effect on seatbelt wearing behaviour.

Although increasing the perceived risks of not wearing a seatbelt may seem the natural choice for targeting inconsistent seatbelt users, an alternative strategy would be to provide “pauses for thought” – giving people a reason to think about their own seatbelt wearing behaviour. This could include the positives of wearing a seatbelt as well as the negatives of not wearing. (Christmas et al, 2008)

Perceived risk of legal penalty

Stasson and Fishbein (1990) found no direct relation between perceived risk and seatbelt use. However, the 'risk' they measured against was that of having an accident. But, the perceived risk of getting caught by the police for not wearing a seatbelt is a key part of a person's risk-analysis. (Christmas et al, 2008)

Examining the relationship between the perceived risk of being ticketed and self-reported seatbelt use, a study using data from 26,063 drivers collected as part of an evaluation of the US 'Click It or Ticket' campaign in 2001, hypothesised that individuals who report using their seatbelts more will have a higher perceived risk of being ticketed than those who report using their seatbelts less. (Chaudhary et al (2004))

The US 'Click It or Ticket' campaign comprised adverts warning drivers about increased police enforcement of seatbelt laws, followed by a period of highly visible enforcement. Data was collected two weeks before the campaign, during the campaign, and one week immediately after the campaign had finished. Participants were asked, 'How often do you use seatbelts when you...', and, 'What do you think your chances are of getting a ticket if you don't wear your seatbelt?' Participants' age, annual distance driven and vehicle most often driven were also recorded.

The results showed that, as predicted, people who reported always wearing their seatbelt also reported significantly higher perceived risk of being ticketed than those who reported not always wearing their seatbelt. Women reported a higher perceived risk of being ticketed than men and a significantly higher percentage of women than men also reported that they always use their seatbelt.

For both male and female pick-up drivers, the study found that those who reported always wearing their seatbelt also had significantly higher perceived risk of being ticketed than those who reported not always wearing their seatbelt. However, it noted that there was another factor besides perceived risk of being ticketed that caused pick-up drivers to wear their seatbelts less than car drivers.

The report also found that drivers with higher annual miles driven were less likely to report always wearing a seatbelt, and had a lower perceived risk of being ticketed. The data thus suggested that a higher perceived risk of being ticketed acts as a motivator for wearing seatbelts.

Both seatbelt use and perceived risk of being ticketed, were significantly higher immediately after the Click It or Ticket campaign, than before. The report recommended, therefore, that publicity and enforcement campaigns focus on the perception of enforcement, "Higher fines will have only nominal impact on restraint use if drivers feel they are unlikely to be ticketed and therefore have to pay the higher fine", (2004: 389).

The finding that risk of enforcement affects seatbelt wearing behaviour is also supported by Christmas et al (DfT, 2008). They asked nearly 2000 adults to select in which of 20 different situations they would most likely wear a seatbelt. The situation in which people were *most* likely to wear a seatbelt was if the front-seat passenger put their seatbelt on. The second situation most likely to make people wear a seatbelt was if they were driving when there are police around.

The 2012 Think! Annual Survey revealed that for 1,184 adult respondents, a visible police presence was still the most effective influencer on how safely they drove. (TNS-BMRB 2012)

Mohamed et al (2011) also found that enforcement activities had the largest impact on rear-seatbelt wearing behaviour. They too advocated publicity focus on the visibility of enforcement activities.

A review of 33 research reports of the effectiveness of seatbelt laws in the USA, identified 18 studies of enhanced enforcement programmes (periods of increased specific enforcement of seatbelt laws combined with publicity). The evidence indicated that enhanced enforcement programmes (enforcement plus publicity) are associated with an increase in seatbelt use and a decrease in injuries. Thus providing more evidence that a heightened perceived risk of being ticketed increases seatbelt wearing behaviour. (Dinh-Zarr et al, 2001)

Habitual behaviour

A survey of 948, 21 year olds in New Zealand found that, for all seating positions, “forgetfulness” or “not in the habit” were the most common reasons given for not using a seatbelt. These reasons accounted for between 42% and 58% of all recorded explanations for why respondents did not “always” wear a seatbelt. A perceived low risk of injury from not wearing a seatbelt only accounted for between 13% and 17% of explanations for non-use. The reason of “forgetfulness” or “not in the habit” was most frequently given by rear seat passengers than for any other seating position. The authors suggested that this lack of habit may be because the cohort of 21 year olds did not legally have to wear a seatbelt or child restraint in the rear when younger. (Begg and Langley, 2000)

Christmas et al (2008) reported that adults who had been stopped by the police for non-use of seatbelts explained their infringement by stating how they “normally wear a belt” but that on the occasion they were stopped by the police, something had caused that habit to fail. Common reasons given for this habit failure were being in a hurry, or having been distracted. The authors, however suggested that these reasons signalled more of a “habit lack” than a “habit failure”. They suggested that an ingrained habit was unlikely to frequently fail for reasons such as being in a hurry or being distracted.

The report suggested that there is a need to find ways to encourage habit-forming seatbelt wearing behaviour, and that one way of prompting habit-forming behaviour would be to remove perceived reasons not to wear a seatbelt (e.g. discomfort) and to supply positive reasons to wear seatbelts in situations where they are not already routinely worn.

The argument for promoting habit-forming seatbelt wearing behaviour supports Schwarzer et al's (2007) claim that strategic planning (i.e. when, where, and how) connects good intentions with actual behaviour.

Seat belt Reminders

Seat belt reminders (SBR) are an in-vehicle technology that alerts drivers if the seat belts in occupied seats are not being used. Most commonly, the reminder is a visual display or an audible alarm.

EuroNCAP award vehicle models points if they are fitted with a seat belt reminder; this can help the vehicle to get a higher star rating. EuroNCAP also specify several standards that the reminder system must meet.

One early study on the effectiveness of seat reminder systems at encouraging seat belt use was conducted in the USA (Williams, Wells and Farmer, 2002). This was based on observations on seat belt wearing made when drivers took their car to one of 6 car dealerships for a service. This method made it simpler to get details about which vehicles were fitted with a seat belt reminder system. Seat belt use was around 68% in the state at the time of the study. 71% of drivers without the reminder and 76% of drivers with the reminder used their seat belt when driving into the garage; this finding was unlikely to be due to chance.

A study was conducted in seven European cities to see how seat belt reminder systems influenced seat belt use (Lie, Kullgren, Krafft, Tingvall, 2007). Observations were made of several preselected car models that were categorised depending on whether they were fitted with an SBR that met EuroNCAP's standards, a milder SBR, or did not have a reminder system. For all observations the total wearing rate was 97.5% in cars fitted with SBR that met EuroNCAP standards, compared to 85.5% in models of cars without. The wearing rate in cars with a mild SBR was 93.2%.

As well as how they influence wearing rates, other studies have looked at the association between seat belt reminders and driver fatality risk (Farmer and Wells, 2010). This used records of driver deaths in the USA between 2000 and 2007, and the number of driver deaths per vehicle registration was calculated for vehicles with and without SBR that met the USA standards. The fatality rate was 6% less in vehicles fitted with SBR, which was unlikely to be due to chance. When these results were adjusted to remove any differences in vehicle age between the two groups, it was found that the fatality rate was 2% less in vehicles fitted with SBR, although it was more likely that this was due to chance.

CONCLUSION

Seat belts are highly effective in protecting vehicle occupants and significantly reducing their risk of being fatally or seriously injured in a crash. They are designed to work as a key part of a wider occupant restraint system that includes airbags, head restraints, vehicle seats and structure.

The latest seat belts are designed to work as part of the vehicle's smart restraint system.

Three point seat belts are most effective, but lap belts nevertheless provide significant levels of protection.

Seat belt laws increase seat belt use, and so reduce death and injury.

Although seatbelt wearing rates are high, not everyone wears a seatbelt *all* of the time. Seatbelt use in the rear of a vehicle is consistently lower than in the front.

Seatbelt wearing can be improved by increasing positive attitudes towards seatbelt use, rather than relying on fear appeals. The benefits of wearing seatbelts need to be promoted, and the perceived reasons for not wearing seatbelts reduced.

Enhancing positive normative views of seatbelt wearing behaviour may have more impact on an individual's seatbelt use than increasing their perception of the risk of injury. However, some people intent on taking risks may actively seek to behave in ways that are considered socially undesirable. The normative views of their immediate peers would, therefore, need specific targeting.

As intentions predict behaviour, studies recommended that planning and coping strategies be promoted to help people adhere to their good intentions. Planning and coping strategies may help to embed seatbelt wearing behaviour and thereby form resilient seatbelt wearing habits.

Although an increase in perceived risk of injury or accident seems to have little direct impact on seatbelt wearing behaviour, individuals who reported always wearing their seatbelt also reported significantly higher perceived risk of legal penalty than those who do not always wear a seatbelt.

Visible police enforcement appears to increase both perceived risk of legal penalty and actual seatbelt use. Enhanced enforcement programmes consisting of highly visible and publicised periods of seatbelt law enforcement have been found to increase seatbelt wearing rates and reduce injuries.

It is unclear, however, whether it is the risk of being stopped by the police, or the threat of legal penalties that has the greatest impact. This distinction is important if seatbelt diversion schemes are to be promoted whereby offenders are offered an educational intervention in lieu of a fixed penalty.

SEAT BELTS: REFERENCES

Title:	A Statistical Analysis of 28,00 Accident Cases with Emphasis on Occupant Restraint Value
Author:	N. I. Bohlin
Published:	SAE, 1967
Link:	http://papers.sae.org/670925/
Objectives:	To establish the effectiveness of the three point seat belt.
Methodology:	A cohort study of 297,000 vehicles.
Key Findings:	
<ul style="list-style-type: none"> • There were 37,761 accidents reported during the study period, of which 28,780 were analysed. • Three point seat belts were 40% to 90% effective at preventing all injuries, depending on the speed of the impact. • Unbelted occupants sustained fatal injuries at speeds lower than 20mph • None of the belted occupants were fatally injured at speeds less than 60mph • None of the belted occupants were ejected from the vehicle 	
Format: Pdf	Cost: Priced

Title:	Usage and effectiveness of seat and shoulder belts in rural Pennsylvania accidents
Author:	Charles Jesse Kahane
Published:	DOT HS-801 398, 1974
Link:	http://ntl.bts.gov/lib/25000/25300/25378/DOT-HS-801-398.pdf
Objectives:	To analyse the effectiveness of lap belts and shoulder belts for car occupants involved in accidents in rural Pennsylvania.
Methodology:	Analysis of police recorded data from 40,000 occupants involved in accidents. The proportion of occupants with different levels of injury severity were calculated for each type of restraint and compared.
Key Findings:	
<ul style="list-style-type: none"> • Lap belted occupants had a 73% lower fatality rate, 53% lower serious injury rate and 38% lower injury rate than unrestrained occupants. • None of the 815 occupants in the sample who were wearing a three point belt were killed. • Compared to unrestrained occupants, wearing a lap belt reduced the likelihood of being ejected by 68%, and wearing a three point belt reduced the rate by 72%. 	
Format: Pdf	Cost: Free

Title:	A statistical analysis of seat belt effectiveness in 1973-75 model cars involved in tow-away crashes
Author:	Donald W. Reinfurt, Claudio Z. Silva, Andrew F. Seiva
Published:	DOT HS 802 035, 1976
Link:	http://ntl.bts.gov/lib/25000/25300/25364/DOT-HS-802-035_001.pdf
Objectives:	To calculate an accurate assessment of the effectiveness of seat belts at preventing injury by overcoming several of the data collection issues which biased previous results.
Methodology:	Detailed information was collected on over 15,000 towaway accidents involving 1973-75 model passenger cars from 5 sites in the USA. Standardised injury rates were calculated, and compared in order to establish seat belt effectiveness. Confounding variables between the groups were corrected in the statistical analyses
Key Findings:	
<ul style="list-style-type: none"> • The study examined the effectiveness of seat belts at preventing injuries which were judged to be 'moderate' severity and above. • Compared with unrestrained occupants, using a lap belt reduced the injury rate by 31%. • In frontal impacts the rate was reduced by 23%, and in side impacts it was reduced by 40%. • Compared with unrestrained occupants, using a three point belt reduced the overall injury rate by 56.5%. In frontal impacts the rate was reduced by 53%, and in side impacts it was reduced by 59%. 	
Format: Pdf	Cost: Free

Title:	Estimates of Motor Vehicle Seat Belt Effectiveness and Use: Implications for Occupant Crash Protection
Author:	Leon Robertson
Published:	American Journal of Public Health, September 1976, Vol 66, No 9.
Link:	http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1653464/pdf/amjph00496-0031.pdf
Objectives:	To identify the sources of bias in published studies on the effectiveness of seat belts.
Methodology:	A review of previous studies on the effectiveness of seat belts.
Key Findings:	
<ul style="list-style-type: none"> • Nineteen studies were identified and the estimates of seat belt effectiveness at preventing fatal (and in some studies also serious) injury ranged from 7.5% to 85.6%. • Two errors that can seriously bias estimates of seat belt effectiveness were identified: <ol style="list-style-type: none"> 1. False reporting of whether a belt was being used or not, and a difference between claimed and actual belt use. 2. Whether or a crash is included in the study, which is affected by the presence or severity of injuries suffered by people involved in the crash. 	
Format: pdf	Cost: Free

Title:	Alleviation of injuries by use of seat belts
Author:	Barbara Sabey, B.E Grant and C.A Hobbs
Published:	Transport and Road Research Laboratory, TRRL Supplementary Report 289, 1976
Link:	https://trl.co.uk/reports/SR289
Objectives:	To present the results of recent studies on occupant injury.
Methodology:	An analysis of a representative sample of 2,879 vehicle occupants, including 1,000 occupants who were uninjured, involved in accidents. A comparison was made between the levels of injury received between occupants wearing a seat belt or not.
Key Findings:	<ul style="list-style-type: none"> • The use of seat belts resulted in a statistically significant reduction in 'life threatening' injuries of 86%. • Wearing a seat belt resulted in a 50% increase in the likelihood of being uninjured in an accident, with 42% of belted occupants escaping uninjured, compared to 28% of unbelted occupants.
Format: Printed copy	Cost: unavailable online

Title:	The Effectiveness of Seat Belts in Reducing Injuries to Car Occupants
Author:	C.A Hobbs
Published:	Transport and Road Research Laboratory, TRRL LR 811, 1976
Link:	https://trl.co.uk/reports/LR811
Objectives:	To calculate the effectiveness of seat belts.
Methodology:	An in-depth study of 1,126 accidents between 1974 and 1976. Accidents were included if more than one person was injured and attended the local hospital; the hospital data was matched with police reports on the collisions. There were 2,879 vehicle occupants in the sample, including 1,100 who were uninjured. Only data from front seat occupants was used. Information on the injuries was collected and coded by severity and location on the body, using the Abbreviated Injury Scale (AIS).
Key Findings:	<ul style="list-style-type: none"> • 490 front seat occupants were wearing belts, 1,163 were not, and in 303 cases seat belt use was not known. • Of the belted occupants, 42% were uninjured compared with 28% of the unbelted occupants. • There was a 45% reduction in severe or life threatening injuries, which were sustained by 107 of the 1,163 unbelted occupants and 25 of the 490 belted occupants. There was a 95% certainty that the true reduction was between 65% and 13%. • There was a 44% reduction in injuries classed as 'moderate' with 261

<p>sustained by the unbelted occupants and 62 by the belted ones. There was a 95% certainty that the true reduction lay between 58% and 42%.</p> <ul style="list-style-type: none"> • There was no significant difference in minor injuries between the two groups. • Head injuries were the most common injury recorded in the sample, but there were significantly fewer head injuries coded as AIS 2 or higher among the belted occupants. • The rate of head injuries was 237 per 1,000 unbelted occupants to 106 per 1,000 who were belted. Usually the injury was caused by contact with the steering wheel among belted occupants or contact with the steering wheel and area around the windscreen for unbelted occupants. • Seat belts prevented the occupant from being ejected from the vehicle, and that just under a quarter of those thrown from the vehicle were fatally injured. 	
Format:	Cost: Priced

Title:	An in-depth study of road accident casualties and their injury patterns
Author:	Tunbridge RJ, Everest JT, and Wild BR
Published:	Transport and Road Research Laboratory, TRRL report RR136-7. Crowthorne: TRL, 1988
Link:	https://trl.co.uk/reports/RR136
Objectives:	To use hospital data to assess the severity of injuries on a clinical basis and the degree of underreporting in police data.
Methodology:	The study collected information on road accident casualties, presenting to hospital, for the whole of Oxfordshire for 1983 and 1984
Key Findings:	
<ul style="list-style-type: none"> • In the sample there were 5 fatal injuries in the 70 occupants who were unbelted, and 16 fatal injuries amongst the 925 who were belted. • Rear seat passengers of cars (if unbelted) had a very significantly greater chance of being ejected, and thereby being severely injured, than front seat occupants. 	
Format:	Cost: Priced

Title:	Final Regulatory Impact Analysis Amendment to FMVSS No 208. Passenger Car Front Seat Occupant Protection
Author:	NHTSA, U.S. Department of Transportation, 1984
Published:	NHTSA, U.S. Department of Transportation, 1984
Link:	http://www-nrd.nhtsa.dot.gov/pubs/806572.pdf
Objectives:	To review accident data to develop estimates of the effectiveness of air bags without belts, with lap belts, and with three point belts; manual lap belts, manual lap and shoulder belts; and automatic belts.
Methodology:	Routinely collected NHTSA data from three different sources was analysed to compare injuries whilst using different restraint systems, and corrected for four confounding factors – age of occupant, accident severity, impact location (front, side, etc, and size of car).
Key Findings:	
<ul style="list-style-type: none"> • Three point belts were 40%-50% effective at preventing fatal injuries, 45%-55% effective at preventing serious injuries and 10% effective at preventing slight injuries. 	
Format: pdf	Cost: Free

Title:	The Effectiveness of Safety Belts in Preventing Fatalities
Author:	Leonard Evans
Published:	Accident Analysis and Prevention, Vol 18, No 3, pp 229-241, 1986
Link:	http://www.sciencedirect.com/science/article/pii/001457586900072
Objectives:	To calculate the effectiveness of seat belts at preventing front seat occupant fatalities.
Methodology:	Data from the Fatal Accident Reporting System was used to examine the ratio of the proportion of fatally injured occupants in vehicles where both front passengers were not wearing seatbelts, and in vehicles where the driver was wearing a seat belt but the front passenger was not. The ratio of these two ratios was used to calculate effectiveness.
Key Findings:	
<ul style="list-style-type: none"> • Three point belts were 41% effective at preventing fatal injury (standard error of 4%). 	
Format: pdf	Cost: Priced

Title:	Effectiveness of safety-belt use: A study using hospital-based data for nonfatal motor-vehicle crashes
Author:	Judith M. Conn, Terence L. Chorba, Timothy D. Peterson, Philip Rhodes, Joseph L. Annest
Published:	Journal of Safety Research Volume 24, Issue 4, Winter 1993
Link:	http://www.sciencedirect.com/science/article/pii/002243759380003T
Objectives:	To estimate the effectiveness of safety belts at preventing serious injury.
Methodology:	Data, collected by nurse interview, from 893 front seat passenger occupants treated for injury in hospital was analysed, and controlled for the effects of vehicle speed at impact, size of vehicle, type of crash and the occupants' age, gender and seating position.
Key Findings:	
<ul style="list-style-type: none"> • The crude odds of being severely injured were 4.4 times greater for occupants who were unbelted than for occupants who were belted. • Safety belt use was more effective at preventing serious injury in occupants of large cars than small cars. • An overall adjusted odds ratio which controls for confounding factors could not be calculated due to the interaction between seat belt use and vehicle size. 	
Format: pdf	Cost: Priced

Title:	Rear seat restraint system effectiveness in preventing fatalities
Author:	Leonard Evans
Published:	Accident Analysis & Prevention Volume 20, Issue 2, April 1988
Link:	http://www.sciencedirect.com/science/article/pii/0001457588900292
Objectives:	To calculate the effectiveness of seat belts at preventing rear seat occupant fatalities in all crashes.
Methodology:	The double pair comparison method was applied to data from the Fatal Accident Reporting System between 1975 and 1988.
Key Findings:	
<ul style="list-style-type: none"> • The seat belts in the data set were predominantly lap belts • The effectiveness of the lap belts in the outboard positions was estimated to be 18%, with a standard error of 9%. • This meant there was a 39 in 40 chance that the lap belts did reduce the risk of occupant fatality, but only a 1 in 10 chance that this reduction was over 30%. 	
Format: pdf	Cost: Priced

Title:	Rear Seat Belt Effectiveness in Michigan
Author:	Kenneth Campbell
Published:	SAE International Congress, Detroit Michigan, Feb 27, 1987
Link:	http://deepblue.lib.umich.edu/bitstream/2027.42/767/2/78153.0001.001.pdf
Objectives:	To estimate the effectiveness of rear restraint use to prevent fatal and serious injuries in Michigan, following the introduction of laws requiring front seat occupants to wear belts.
Methodology:	The seat belt wearing status of injured rear seat occupants in police reported accidents were compiled. The proportion of occupants suffering serious and fatal injuries in both groups was calculated and compared to calculate the effectiveness at preventing fatal or serious injuries amongst injured occupants.
Key Findings:	<ul style="list-style-type: none"> • There were several issues with data quality in the accident database, such as the accurate recording of belt use and occupant gender or age. • Seat belts in the rear were 26% effective at preventing a serious or fatal injury amongst adult passengers in the rear seat using the 1984 data. • Estimates of seat belt effectiveness doubled following the law, but the authors argue that this was due to changes in how the seat belt use data was coded.
Format: pdf	Cost: free

Title:	Performance of Lap Belts in 26 Frontal Crashes
Author:	National Transportation Safety Board
Published:	NTSB/SS-86/03, 1986
Link:	http://trid.trb.org/view.aspx?id=305976
Objectives:	To learn about the performance of lap belts by investigating individual cases.
Methodology:	Case series and literature review
Key Findings:	<ul style="list-style-type: none"> • There were 139 occupants included in the case series. • 57 occupants were unrestrained, of whom 4 were fatally injured. • One occupant was fatally injured out of 32 who were using the three point belt. • There were 13 deaths amongst the 50 who were using lap belts in the sample. • The report argued that amongst the 50 people using a lap belt, 32 of them would have fared substantially better if they had been wearing a three point belt.
Format: Printed	Cost: Priced

Title:	A Quantification of the Impact of Restraining Systems on Passenger Safety
Author:	Saeed Maghsoodloo, David B. Brown, Yuh-Ing Shieh
Published:	Journal of Safety Research Volume 20, Issue 3, Autumn 1989
Link:	http://www.sciencedirect.com/science/article/pii/0022437589900571
Objectives:	To examine the effectiveness of safety belts.
Methodology:	Accident data from Alabama was collected between 1984 and 1987, including information on occupants who were uninjured. The proportion of occupants suffering different severities of injury were calculated and compared.
Key Findings:	
<ul style="list-style-type: none"> • The effectiveness of seat belts at preventing fatalities in the rear was estimated at 8%, with no confidence intervals provided in the paper. • There were very low numbers of restrained passengers who were fatally injured in the rear which were recorded by the police in the time period. • The lap belts were estimated to be 57% effective at preventing serious injuries in the rear, with a standard error of 0.74%. 	
Format: pdf	Cost: Priced

Title:	Effectiveness of Lap/Shoulder Belts in the Back Outboard Seating Positions
Author:	NHTSA
Published:	DOT HS 808 945, June 1999
Link:	http://www-nrd.nhtsa.dot.gov/Pubs/808945.pdf
Objectives:	To evaluate the effectiveness of lap/shoulder belts and determine if they are more effective than lap belts for rear seat occupants. To determine whether lap belts are effective, whether they are harmful to rear seat users, and whether three point belts correct any problems.
Methodology:	Double pair comparison
Key Findings:	
<ul style="list-style-type: none"> • In all crashes, rear seat lap belts are 32% effective in reducing fatalities when compared to unrestrained back seat occupants. The effectiveness estimate is statistically significant with confidence bounds: 23% to 40%. • In all crashes, rear seat three point belts are 44% effective in reducing fatalities when compared to unrestrained back seat occupants. The effectiveness estimate is statistically significant with confidence bounds: 38%to 50%. 	
Format: pdf	Cost: Free

Title:	Reduced fatalities related to rear seat shoulder belts
Author:	Leon S Robertson
Published:	Injury Prevention 1999;5:62-64
Link:	http://injuryprevention.bmj.com/content/5/1/62.long
Objectives:	To determine the effect on fatality rates of the installation of three point belts.
Methodology:	Fatalities to rear outboard seat occupants were matched with data on the availability of three point belts in different models of cars. A regression analysis on death rates per occupants was carried out.
Key Findings:	
<ul style="list-style-type: none"> • The risk of death is significantly lower in vehicles equipped with shoulder belts. • The lower risk of death in vehicles fitted with shoulder belts was found in every age group. • Controlling for other factors, death rates are lower among children and highest for occupants aged 45 years and over. • Death rates were lower amongst occupants of mid-sized or larger cars. 	
Format: pdf	Cost: Free

Title:	Association of rear seat safety belt use with death in a traffic crash: a matched cohort study
Author:	Motao Zhu, Peter Cummings, Haitao Chu, Lawrence J Cook
Published:	Injury Prevention 2007;13:183-185
Link:	http://injuryprevention.bmj.com/content/13/3/183.abstract
Objectives:	To estimate the association between using or not using a seat belt in the rear of the car and death.
Methodology:	A matched cohort study
Key Findings:	
<ul style="list-style-type: none"> • Rear seat occupants who wear a seat belt in a car reduce their risk of death by approximately 60%. • Rear seat belts are more effective at preventing injury in rollover accidents. • Seat belts were more effective amongst passengers aged 16 and 64 years. 	
Format: pdf	Cost: priced

Title:	The Handbook of Road Safety Measures, Second Edition
Author:	Rune Elvik, Alena Høye, Truls Va and Michael Sørensen
Published:	2009
Link:	Unavailable online
Objectives:	To identify the best estimate of seatbelt effectiveness for different levels of injury and different seating positions.
Methodology:	Meta analysis of 29 studies of seat belt use
Key Findings: Seatbelts are effective at preventing injury, especially more severe injuries.	
Drivers of cars and vans	
<ul style="list-style-type: none"> • Seat belts are 50% effective at preventing fatal injuries. • Seat belts are 45% effective at preventing serious injuries, • Seatbelts are 25% effective at preventing minor injuries was 25%. 	
Front seat passengers	
<ul style="list-style-type: none"> • Seat belts are 45% effective at preventing fatal injuries. • Seat belts are 45% effective at preventing serious injuries • Seat belts are 20% effective at preventing minor injuries. 	
Rear seat passengers	
<ul style="list-style-type: none"> • Seat belts are less effective at preventing injuries in the rear seats. • Seat belts are 25% effective at preventing fatal injuries • Seat belts are 25% effective at preventing serious injuries • Seat belts are 20% effective at preventing minor injuries was 20%. 	
Format: book	Cost: Priced

Title:	Estimating seat belt effectiveness using matched-pair cohort methods
Author:	Peter Cummings, James D. Wells, Frederick P. Rivara
Published:	Accident Analysis & Prevention, Volume 35, Issue 1, January 2003, Pages 143–149
Link:	http://www.sciencedirect.com/science/article/pii/S0001457501000872
Objectives:	To estimate seat belt effectiveness based on US data for fatal crashes between 1986 and 1998, and investigate reasons why the estimate apparently varies over time.
Methodology:	Matched pair cohort of 88,778 cars 1986 through to 1998
Key Findings:	
<ul style="list-style-type: none"> • The overall estimate for relative risk reduction between belted and unbelted occupants was 0.39, with 95% confidence intervals from 0.37 to 0.41. • This estimate was the same for both genders; however, the estimate for the effectiveness of the seat belt did vary with age and seatbelts became progressively less effective for each older age band. • The authors investigated reasons why their estimate showed that seat belts were more effective than previous studies and found that a consistent low level of misclassification of use against a backdrop of increasing seat belt use could account for the difference. 	
Format: pdf	Cost: Priced

Title:	Fatality Reduction by Safety Belts for Front-Seat Occupants of Cars and Light Trucks
Author:	NHTSA
Published:	DOT HS 809 199
Link:	http://www-nrd.nhtsa.dot.gov/pubs/809199.pdf
Objectives:	To refine NHTSA's estimate of the effectiveness of seat belts.
Methodology:	Double pair comparison, controlling for crash type.
Key Findings:	
<ul style="list-style-type: none"> • A 45% reduction in the number of fatalities in passenger cars when comparing belted to unbelted occupants. • A 60% reduction in fatalities in light trucks when comparing belted to unbelted occupants. • Three point belts in cars were most effective in head on crashes, showing a best estimate of a 50% reduction in fatalities. • Seatbelts were most effective at preventing fatalities in a rollover accident, showing a best estimate of a 74% reduction in fatal injuries. • Seatbelts were least effective in side impacts, with a 10% reduction in fatalities from impacts on the same side as the occupant and a 39% reduction in fatalities in far side impacts. 	
Format: pdf	Cost: Free

Title:	The Long Term Effect of Seat Belt Legislation On Road User Injury Patterns
Author:	R J Tunbridge
Published:	TRRL Research Report 239, 1989
Link:	https://trl.co.uk/reports/RR239
Objectives:	<ul style="list-style-type: none"> • To compare car occupant casualty rates and injury patterns for an extended period before and after seat belt legislation was introduced, using an independent set of hospital data • To assess the effects of seat belt legislation on casualty rates among road users other than car occupants.
Methodology:	Hospital inpatient data was linked with STATS 19 to compare the 3 years before and after the introduction of the seat belt law.
Key Findings:	
<p>The study compared the number of inpatients in 1980-82 with 1983-85</p> <ul style="list-style-type: none"> • The number driver casualties reduced from 4,768 to 3,804, a 20.2% reduction • The number of front seat passenger casualties reduced from 2,396 to 1,559, a 33.3% reduction • The number of drivers seriously injured fell from 787 to 633, a 19.6% reduction • There were significant reductions in the number of skull or face fractures amongst front seat passengers. Similar reductions amongst drivers were not statistically significant. • There was a non-significant increase in the number of sprained necks amongst drivers and front seat passengers • The number of drivers and front seat passengers with fractured sterna 	

increased from 61 to 129, and 20 to 90, respectively.	
<ul style="list-style-type: none"> Despite conducting a series of extensive time series analyses on the data, there were no significant changes in any of the categories of recorded non-car occupant casualties. 	
Format:	Cost: Priced

Title:	Road Casualties in Great Britain During the First year With Seat Belt Legislation
Author:	P P Scott and P A Willis
Published:	TRRL Research Report 9, 985
Link:	https://trl.co.uk/reports/RR9
Objectives:	To analyse the effect of a law on seat belt use.
Methodology:	Comparison of the 12 month period before and after the introduction of the law
Key Findings:	
<ul style="list-style-type: none"> Seat belt use increased from around 40% to 95% amongst drivers and front seat passengers. A 25% reduction in driver fatalities and a 21% reduction in driver serious injuries. A 29% reduction in front seat passenger fatalities, and a 30% reduction in front seat passenger serious injuries. No large or significant changes in the number of injured vulnerable road users were identified. 	
Format:	Cost: Priced

Title:	The Medical Effects of Seat Belt Legislation in the UK
Author:	William Rutherford, Tony Greenfield, HRM Hayes, JK Nelson
Published:	Department of Health and Social Security, Office of the Chief Scientist Research report No 13
Link:	Unavailable online
Objectives:	To establish sound evidence of the changes in hospital casualties among car occupants injured in road accidents in consequence of the introduction of compulsory seat belt legislation in the UK.
Methodology:	Data on injuries before and after the introduction of the legislation to wear seat belts was collected from several hospitals. A further study was conducted using data from eight coroner's districts in England.
Key Findings:	
<ul style="list-style-type: none"> There was a large reduction in serious injuries amongst front seat occupants, which fell from 1,669 the year before the law was introduced to 1,298 the year after. There were 286 rear seat occupants who were seriously injured in the year before the law and 290 the year after. There were 101 deaths from injuries to car occupants in the eight districts in the year before the study, and 75 in the year after. There was a 2% to a 9% increase in the amount of traffic the year following the seat belt law and no major differences in the weather between the two years. 	

Format: Printed	Cost: Priced
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Title:	The Effects of Seat Belt Legislation on Road Casualties
Author:	J Durbin and AC Harvey
Published:	In Compulsory Seatbelt Wearing Report, Department of Transport, 1985
Link:	Unavailable online
Objectives:	To assess the statistical evidence of the effects of the introduction of the seat belt law on road casualties in Great Britain.
Methodology:	Time series analysis using monthly casualty figures dating from January 1969 to December 1984.
Key Findings:	
<ul style="list-style-type: none"> • The authors found a 20% to 26% reduction in the number of drivers killed or seriously injured. The number of driver deaths fell by 18%. • There was a 2.9% rise in the number of rear seat occupants who were killed or seriously injured, however this was not statistically significant. • The authors estimated that the seat belt law saved the lives of 241 drivers in 1983 and 270 in 1984. • Similar estimates were made for front seat passengers, where an estimated 147 lives were saved in 1983 and 181 in 1984. • There was a 4.8% increase in the number of cyclists killed or seriously injured following the introduction of the law; however, this was not statistically significant. 	
Format: Printed	Cost: Priced

Title:	Seat-belt use and Related Behaviours Among Young Adults
Author:	Begg, D.J, and Langlely, J.D
Published:	Journal of Safety Research (2000) Vol. 31 No. 4
Link:	http://www.sciencedirect.com/science/article/pii/S002243750000384
Objectives:	To obtain information about the background and behaviour of young adults who do not use seatbelts
Methodology:	Cross-sectional survey of 21 year old members of the cohort of a New Zealand longitudinal study. Significance set at the 0.01 level and data analysed using chi-square and multiple regression.
Key Findings:	
<ul style="list-style-type: none"> • 91% always used a seatbelt as a driver or front-seat passenger. • 40% always used a seatbelt as a rear-seat passenger. • Females reported higher use than males. • Among the males, front seatbelt users were significantly less likely than non-users to drive after drinking too much, drive after using marijuana, take deliberate risks, or to have been disqualified from driving. • The most common reasons given for not using a seatbelt are “forgetfulness” or “not in the habit”. 	
Format: PDF	Cost: priced

Title:	Post Evaluation of the 'Three Strikes' Think! Seatbelts Campaign
Author:	BMRB Social Research
Published:	Department for Transport (2009)
Link:	http://webarchive.nationalarchives.gov.uk/+http://think.dft.gov.uk/pdf/332982/332986/0901-seatbelts-post.pdf
Objectives:	Post-stage evaluation of the 'Three Strikes' Think! seatbelt campaign
Methodology:	Random location quota sample. Omnibus questionnaire survey of 1956 people aged 15+. Interviews were conducted at the respondents' homes using CAPI.
Key Findings:	
<ul style="list-style-type: none"> • 84% of respondents recognised at least one of the adverts used in the campaign. • 41% of respondents reported that the adverts made them think they should always wear a seatbelt. • 11% of respondents agreed the advert was aimed at 'people like me'. • 8% increase in the proportion of 17-34 year olds (19%) who spontaneously mentioned death as a likely consequence of not wearing a seatbelt. • 5% increase in the proportion of 17-34 year olds (16%) who spontaneously mentioned serious injury as a likely consequence of not wearing a seatbelt. • 70% of adults completely agreed that it was dangerous not to use a seatbelt in the front of a car – lower than at pre-campaign baseline. • 85% of adults strongly disagreed that it is safe to travel at 30mph without a seatbelt in the rear of a car – 8% lower than at pre-campaign baseline. • Increase in the proportion of both front and rear seat passengers who said they did not always wear a seatbelt. • No change from pre-campaign baseline in the proportion of drivers who said they did not always wear a seatbelt when driving. 	
Format: PDF	Cost: Free

Title:	Seat Belt Wearing in Scotland: A Second Study on Compliance
Author:	Burns, A., Kummerer, M., and Macdonald, N.C
Published:	Scottish Executive Social Research (2002)
Link:	http://www.scotland.gov.uk/Publications/2003/01/16089/16092
Objectives:	To update and compare with data gathered in 1997
Methodology:	Observation
Key Findings:	
<ul style="list-style-type: none"> • Car occupant seatbelt compliance was 93.1%. • Appropriate restraint use falls between the ages of 5 and 14yrs before increasing with age. • Males in the 17 to 29 age group are less likely to use a seat belt than comparable females. • All rear seat passengers should be priority targets for seatbelt wearing campaigns. 	
Format: PDF	Cost: Free

Title:	The Relationship Between Perceived Risk of Being Ticketed and Self-Reported Belt Use
Author:	Chaudhary, N.K., Solomon, M.G., and Cosgrove, L.A.
Published:	Journal of Safety Research (2004) Vol. 35. No. 4
Link:	http://www.sciencedirect.com/science/article/pii/S0022437504000763
Objectives:	To establish evidence supporting the causal link between perceived risk of being ticketed and seatbelt use
Methodology:	Analysis of survey data from the evaluation of the American 'Click It or Ticket' campaign, 2001 using parametric statistics and for some variables the non-parametric chi-squared test.
Key Findings:	
<ul style="list-style-type: none"> • People who always use their seatbelt have a higher perceived risk of being ticketed than those who do not always fasten their seat belts. • Women use their seat belts more than men and have a higher perceived risk of being ticketed. • Perceived risk of being ticketed influences the seatbelt use of drivers of different classes of vehicle. • Higher mileage drivers are less likely to always wear a seatbelt, and to have a lower perceived risk of being ticketed. • The campaign significantly increased both perceived risk of being ticketed and observed seatbelt use. • Evidence of a relationship between seatbelt use and perceived risk of getting a ticket. The higher the perceived risk, the greater the use of seatbelts. • Seatbelt campaigns need to focus on the perception of enforcement. 	
Format: PDF	Cost: Priced

Title:	Strapping Yarns: Why People Do and Do Not Wear Seatbelts
Author:	Christmas, S., Young, D., and Cuerden, R.
Published:	Department for Transport (2008)
Link:	http://webarchive.nationalarchives.gov.uk/20100304070241/http://www.dft.gov.uk/pgr/roadsafety/research/rsrr/theme5/reportno98.pdf
Objectives:	To identify who does not wear a seatbelt and outline the different reasons for non-use
Methodology:	Data from literature reviews, individual interviews, qualitative workshops and questionnaire surveys
Key Findings:	
<ul style="list-style-type: none"> • A consistent minority (14%) of UK adults are inconsistent seatbelt wearers. • Increasing seatbelt use by adults aged 30 years and under would save most casualties. • Approaches to encourage seatbelt use could include prompting people to think about their behaviour; providing messages for use in conversation about seatbelts; information on minor not just major consequences of non-use; and on the benefits of seatbelts. • Non-users lack a seatbelt wearing habit. • Habit-forming behaviour could be prompted by offering positive reasons to wear 	

seatbelts in situations where they are typically less likely to be worn. Habit-forming behaviour could also be prompted by removing reasons for non-use.	
<ul style="list-style-type: none"> • 'Driving when there are police around' was one of the main situations in which people would most likely wear a seatbelt, as was. 'The front seat passenger putting their seatbelt on'. • A separate campaign focussing on rear seatbelt wearing would best tackle reasons for non-use that are unique to the rear seat passenger. 	
Format: PDF	Cost: Free

Title:	Reviews of Evidence Regarding Interventions to Increase the Use of Safety Belts
Author:	Dinh-Zarr, T.B et al
Published:	American Journal of Preventive Medicine (2001) Vol. 21. No. 4
Link:	http://www.sciencedirect.com/science/article/pii/S0749379701003786
Objectives:	To evaluate the effectiveness of three interventions to increase safety belt use
Methodology:	Systematic review
Key Findings:	
<ul style="list-style-type: none"> • 33 studies revealed consistent increases in safety belt use and consistent decreases in fatal and nonfatal injuries after the enactment of safety belt laws. • Primary safety belt laws are more effective than secondary laws in increasing safety belt use and decreasing fatalities. • Strong evidence that enhanced enforcement is effective in increasing safety belt use. • Insufficient economic evaluation data available to assess cost-effectiveness for any of the interventions reviewed. 	
Format: PDF	Cost: Priced

Title:	Analysis of Factors Associated with Seatbelt Wearing Among Rear Passengers in Malaysia
Author:	Mohamed, N., Yusoff, M., Isah, N., Othman, I., Rahim, S-A., and Paiman, N.
Published:	International Journal of Injury Control and Safety Promotion (2011) Vol. 18. No. 1
Link:	http://www.ncbi.nlm.nih.gov/pubmed/20496187
Objectives:	To explore factors associated with rear seatbelt wearing in order to inform future strategies
Methodology:	Questionnaire survey of rear passengers. Analysed using parametric and non-parametric statistics at the 0.05 level of significance.
Key Findings:	
<ul style="list-style-type: none"> • 22% of respondents reported 'always' wearing rear seatbelts. • History of being stopped by an enforcement officer and perception of being caught were significantly associated with rear seatbelt wearing. • History of being stopped by an enforcement officer and perception of being caught were categorised as "cues to action" or "reinforcing factors" for seatbelt 	

wearing.	
<ul style="list-style-type: none"> • Factors which predispose individuals to wear seatbelts were: knowledge of the benefit of wearing a seatbelt, attitude and belief toward wearing a seatbelt. • Higher knowledge and positive attitude toward seatbelt wearing were significantly associated with rear seatbelt use. • Enforcement activities had the biggest impact on rear seatbelt wearing behaviour • Recommends increasing the perception of being caught. • Recommends addressing poor attitudes toward seatbelt wearing. 	
Format: PDF	Cost: Priced

Title:	Adoption and Maintenance of Four Health Behaviours: Theory-Guided Longitudinal Studies on Dental Flossing, Seatbelt Use, Dietary Behaviour, and Physical Activity
Author:	Schwarzer, R., Schuz, B., Ziegelmann, J., and Lippke, S.
Published:	Annals of Behavioural Medicine (2007)
Link:	http://link.springer.com/article/10.1007%2FBF02879897#
Objectives:	To examine the role of self-efficacy and planning in translating intentions into action
Methodology:	Longitudinal survey of students at six randomly selected high schools in Poland. Data analysed by structural equation modelling.
Key Findings:	<ul style="list-style-type: none"> • 42% of seatbelt use variance explained jointly by planning and recovery self-efficacy. • Risk perception was not significantly related to any of the four health behaviours. • The findings suggest that risk communication interventions are not the most suitable for preventive health behaviours. • Recommend instead making people aware of their own skills and strategies to change behaviour. • Planning and recovery self-efficacy, not intention, are the best <u>direct</u> predictors of various health behaviours.
Format: PDF	Cost: Free

Title:	The Relation Between Perceived Risk and Preventive Action: A Within-Subject Analysis of Perceived Driving Risk and Intentions to Wear Seatbelts
Author:	Stasson, M. And Fishbein, M.
Published:	Journal of Applied Social Psychology (1990) Vol. 20 No. 19.
Link:	http://onlinelibrary.wiley.com/doi/10.1111/j.1559-1816.1990.tb01492.x/abstract
Objectives:	To investigate the role of psychological variables in intentions to use seatbelts across a variety of driving situations
Methodology:	79 university students who were licensed drivers completed a questionnaire about driving in 12 different road conditions. The students entered their responses directly into a personal computer. Factor analysis defined the measures of "intention",

	“perceived risk”, “attitude toward wearing a seatbelt”, and “subjective norm”. The correlation between measures was then analysed.
Key Findings:	
<ul style="list-style-type: none"> • The correlation between intention and perceived risk was not significant. • Attitude and norm measures were significantly correlated with behavioural intention in all 12 driving situations. • Perceived risk plays a smaller role than attitudes and norms in predicting intentions to wear a seatbelt. • As driving situations get riskier intentions to wear seatbelts depend more on subjective norms than on attitude. • Seatbelt campaigns should target attitudes and subjective norms. • Campaigns should promote the benefits of wearing seatbelts, and reduce the perceived costs. • Risk focused campaigns can be expected to have little effect on seatbelt wearing behaviour. 	
Format: PDF	Cost: priced from the British Library

Title:	Think! Annual Survey JN: 229150
Author:	TNS-BMRB Report
Published:	Department for Transport (2012)
Link:	https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/8087/think-annual-report-2011.pdf
Objectives:	To use the November 2011 annual survey data to measure road safety attitudes and behaviour among the British population.
Methodology:	Random location quota sample. Omnibus questionnaire survey of 2007 adults aged 16+. Interviews were conducted at the respondents’ homes using CAPI. Significance set at the 0.01 level.
Key Findings:	
<ul style="list-style-type: none"> • In order of self-perceived effectiveness, the four most effective influences on an individual driving safely were: visible police presence, speed cameras, threat of prosecution/penalties and family. • 78% of all respondents felt that not using a seatbelt in the front of a car was dangerous – a 5% reduction from February 2011. • 68% of all respondents felt that not using a seatbelt in the rear of a car was dangerous – a slight reduction from February 2011. • 10% fewer males than females perceived not wearing a seatbelt in the rear of a car as dangerous. • Younger motorists are more likely than older motorists to know someone who does not wear a seatbelt in either the front or rear of a car. 	
Format: PDF	Cost: Free

Title:	Seatbelt and Mobile Phone Usage Surveys: England and Scotland 2009
Author:	Louise Walter (TRL)
Published:	Department for Transport (2010)
Link:	https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/8899/seat-belt-phone-usage.pdf
Objectives:	Annual survey to assess the use of seatbelts by vehicle occupants and of mobile phones by drivers in 2009.
Methodology:	Observation
Key Findings:	
<ul style="list-style-type: none"> • The proportion of car drivers wearing seatbelts remained unchanged at 95%. • The proportion of car front seat passengers wearing seatbelts or the appropriate restraint decreased by 1% from 2008 to 95%. • The proportion of car rear seat passengers wearing seatbelts or the appropriate restraint increased by 1% from 2008 to 89%. • The proportion of drivers of other vehicles wearing seatbelts reduced by 4% from 2008 to 69%. 	
Format: PDF	Cost: Free

Title:	Effectiveness of Ford's belt reminder system in increasing seat belt use
Author:	A F Williams, J K Wells, C M Farmer
Published:	Inj Prev 2002;8:293-296
Link:	http://injuryprevention.bmj.com/content/8/4/293.full
Objectives:	Establish whether the seat belt wearing rate is influenced by seat belt reminder systems
Methodology:	Roadside observations of vehicle wearing rates
Key Findings:	
<ul style="list-style-type: none"> • Seat belt use was around 68% in the state at the time of the study. • 76% of drivers with a seat belt reminder system used their seat belt • 71% of drivers without the reminder used their seat belt 	
Format: pdf	Cost: Priced

Title:	Intelligent seat belt reminders-do they change driver seat belt use in Europe?
Author:	Lie A, Krafft M, Kullgren A, Tingvall C.
Published:	Traffic Inj Prev. 2008 Oct;9(5):446-9.
Link:	http://www.ncbi.nlm.nih.gov/pubmed/18836955
Objectives:	Establish whether the seat belt wearing rate is influenced by seat belt reminder systems
Methodology:	Roadside observations of vehicle wearing rates
Key Findings:	
<ul style="list-style-type: none"> • Observations of seat belt wearing rates were made of several preselected car models in seven European cities • The seat belt wearing rate was 97.5% in cars fitted with SBR that met EuroNCAP standards, • The seat belt wearing rate was 93.2% in cars with a mild SBR, • The seat belt wearing rate was 85.5% in cars without SBR. 	
Format:	Cost:

Title:	Effect of enhanced seat belt reminders on driver fatality risk
Author:	Charles M. Farmer and JoAnn K. Wells
Published:	Journal of Safety Research, Volume 41, Issue 1, February 2010, Pages 53–57
Link:	http://www.sciencedirect.com/science/article/pii/S0022437509001339
Objectives:	Study the influence of seat belt reminder systems on driver fatality risk
Methodology:	Retrospective cohort study
Key Findings:	
<ul style="list-style-type: none"> • The number of driver deaths per vehicle registration were calculated for vehicles with and without seat belt reminder systems in the USA between 2000 and 2007 • The fatality rate was 6% less in vehicles fitted with SBR • After adjusting the results to remove the influence that any differences in vehicle age played on this association, the fatality rate was 2% less in vehicles fitted with SBR. 	
Format: pdf	Cost: priced

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