



road traffic accidents

A review of evidence for prevention
from the UK focal point for violence and injury prevention

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About the UK focal point for violence and injury prevention

The 49th World Health Assembly (1996) declared violence a major and increasing global public health problem. In response, the World Health Organization (WHO) published the *World Report on Violence and Health* and initiated a major programme to support and develop violence and injury prevention work globally. As part of this programme, each member state has designated a national focal point for violence and injury prevention. The network of focal points works with the WHO to promote violence and injury prevention at national and international levels, develop capacity for prevention, and share evidence on effective prevention practice and policy.

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A summary of evidence: successful or promising interventions to prevent road traffic accidents

Adapting the environment: Environmental changes such as implementing area-wide traffic calming measures (e.g. speed humps, 20mph zones and speed cameras), marked pathways for cyclists, and school crossing patrols are effective in reducing road traffic accidents (RTAs) and associated injuries.

Safety education and skills training: There is some evidence that injuries from RTAs can be reduced through education and promotional interventions that encourage the use of safety equipment (often including the provision of discounted or free safety equipment). Less is known about the impacts of: safety education programmes for child pedestrians; driver education programmes; or road safety media campaigns, on injuries. However, these interventions can improve knowledge and safety behaviours.

Addressing drink driving: Bar server training programmes can improve server behaviours (e.g. refusing service to intoxicated patrons) and reduce customer intoxication levels when there is strong support from management. There is some evidence that they can also reduce nighttime RTAs.

Multi-component interventions: Comprehensive programmes that combine strategies such as education and traffic calming measures can reduce the incidence of child pedestrian injury, particularly when a wide variety of organisations are involved.

Enforcement of legislation: Speed enforcement detection devices can be effective in reducing RTAs and associated injuries. There is some evidence that increased policing for drink driving, including selective and random sobriety check points, can have a beneficial effect on road traffic fatalities and crashes.

Injuries from road traffic accidents (RTAs) are a global public health concern. Across the world, an estimated 1.2 million people are killed from RTAs each year and up to 50 million people injured (1). In the UK, improvements in road safety and vehicle design have contributed to a decrease in the level of road traffic injuries in recent years. However, the number of injuries remains high; in Great Britain, over 230,000 people were either killed or injured in an RTA in 2008 alone (2).

Road traffic accidents disproportionately affect certain population groups. For instance, males (2) and those living in more deprived areas (3-6) are most likely to be involved in an RTA. Children and older people also experience higher rates of pedestrian injury than other age groups (7). The use of alcohol or drugs among drivers increases the risk of an RTA (8). Furthermore, alcohol use can increase the severity of injuries sustained from a road accident (e.g. among injured pedestrians [9]). In 2008, 19% of all drivers and riders killed in an RTA in Great Britain were over the legal blood alcohol limit for driving (2). Due to differences in traffic and pedestrian patterns, population densities and road layouts, the frequency and type of accident can also depend on whether an area is urban (city centre), urban fringe (suburban) or rural (countryside) (6,10).

Many RTAs are preventable, and the Department for Transport's "A Safer Way" consultation document has proposed national targets to reduce road deaths and serious injuries by at least 33% by 2020 (11). A wide variety of interventions have been implemented both in the UK and elsewhere to prevent or reduce the occurrence of accidents on the road and the severity of injuries sustained. This document describes these initiatives in more detail and briefly discusses evidence for their effectiveness. With effects on injuries often difficult to determine, many evaluations choose to focus on alternative measures such as changes in safety behaviours or knowledge and attitudes towards safety behaviours.

Road traffic accidents in Great Britain: some facts

- In 2008, over 230,000 people were killed or injured in an RTA, of which around 133,000 were male;
- The rate of casualties per kilometre travelled is highest for drivers and passengers of motorcycles than those for any other vehicle;
- The majority of RTAs and casualties occur on roads with a 30mph speed limit;
- In 2008, there were an estimated 8,640 accidents and 13,020 casualties due to drink driving, although numbers have been falling since 2002;
- The estimated average cost of a road traffic casualty, including medical costs and lost output, is £52,600.

(2)

1. Adapting the environment

Changes to the road environment to reduce traffic volumes and speeds, separate cyclists from other vehicles and improve safety for pedestrians can have a positive impact on levels of RTAs and injuries. The diverse environmental and social characteristics seen between area types (e.g. urban, suburban and rural areas) mean that different locations often require different solutions.

Area-wide traffic calming measures (e.g. speed humps, narrowing roads, 20mph zones or road closures) have been found to reduce traffic speeds and injuries, particularly among children (12-15). In London, a review of 115 20mph zones in 2003 found that (16):

- The average speed within the zones was 17mph;

- Mean traffic speeds had reduced by an average of 9mph and traffic flows by an average of 15% since their implementation; and
- The frequency of injury accidents in the zones had reduced by around 42% and serious or fatal injuries by around 53% since their implementation.

The introduction of 20mph zones in residential areas, or areas frequently used by pedestrians and cyclists, has been recommended in the Department for Transport's "A Safer Way" consultation document (11). Concentrating traffic calming measures in deprived urban areas can help to reduce the inequalities gap in child pedestrian injuries seen between more deprived and less deprived geographical areas (13).

Other evaluated environmental measures to reduce RTAs include:

- *The use of red light cameras* (these identify vehicles crossing a junction after a traffic light has turned red). There is some evidence that they can reduce right-angled collisions, but rear-end collisions have been found to increase, suggesting they may not be a successful safety measure (17);
- *Marked pathways for cyclists on roads*. Clearly marked lanes for cyclists on the road can reduce injury rates when compared to unmarked roads (18);
- *The use of school crossing patrols*. In the UK, an evaluation of their use in the late 1980s suggested that they can reduce the number of accidents occurring to child pedestrians at, or near, crossing sites (19);
- *Safe routes to school initiatives*. These combine different measures to create safer routes to school for children, including: better pavements; traffic calming measures; safe crossings for pedestrians and cyclists; traffic

diversions (e.g. creating pedestrian zones); and sometimes safety education for children (particularly for UK-based programmes). Safe routes to school initiatives are common in the UK but there is little research around their effectiveness. However, there is international evidence that these types of programmes (focusing on environmental measures) can reduce rates of child pedestrian or cyclist accidents (15).

Research exploring the impact of environmental changes tends to focus on urban areas and there are far fewer studies investigating environmental changes in rural locations. However, rural initiatives have included (20-22):

- By-passes that divert traffic out of towns and villages;
- Improving rural routes for walkers and cyclists;
- Reviewing and reducing traffic speeds on country lanes;
- Reducing speeds at problematic junctions or locations (e.g. through the use of vehicle activated signs or rough road surfaces);
- Removing road markings (e.g. central white lines) from narrow roads;
- Designating specific country lanes as “quiet roads”, which are adapted to make them more suitable for walking, cycling and horse riding (e.g. reducing vehicle speeds, restricting access and narrowing roads).

2. Safety education and skills training

2.1 Promoting the use of safety equipment

The use of safety equipment to prevent injuries from RTAs

Safety equipment has an important role to play in preventing RTAs and reducing the likelihood of injury in the event of an accident. It is well known that the use of helmets for motorcyclists (23), and seatbelts and child car seats (booster seats) for vehicle drivers and passengers, reduce the risks of road traffic injury and fatality (24-26).

For cyclists, wearing a helmet is generally regarded as beneficial. Data from case-control studies suggests that cycle helmet use can reduce head, brain and severe brain injury by between 63% and 88% (27). However, these conclusions have been debated (28) and in wider population studies there is no evidence that they can reduce the overall burden of cyclist injuries on the road (29).

A range of educational and promotional methods have been used to encourage the use of safety equipment, often with the provision of free or discounted equipment. These have included: information and lessons targeting parents and/or children; media campaigns highlighting the importance of their use; and health promotion counselling by clinicians. In general, these types of programmes have been successful in increasing the use of safety equipment (e.g. cycle helmet use among children [31,32] and use of booster seats [33,34]). There is less research exploring impacts on injury. However, some evaluations have reported encouraging findings. For instance:

- In the UK, a hospital-led helmet promotion campaign targeting five to 15 year olds used educational methods involving children, parents, schools and safety organisations. These included school-based talks, true case scenarios of

injured children, demonstrations of helmet protection and information about how to wear a helmet properly. Helmets were offered to children at a low cost. Compared to a control group, self-reported helmet use significantly increased among those targeted after a five-year period from 11% to 31%. This was accompanied by a decrease in the rate of accident and emergency (A&E) attendances for cycle injuries and head injuries among children (35);

- Despite noting a need for more high quality interventions, a review of community-based programmes to increase the use of car seat restraints for children reported significant reductions in the risk of vehicle occupant injury following their use (by between 33% and 55% [36]).

2.2 Safety education programmes for pedestrians

Education programmes have been used to increase an individual's ability to cope with traffic environments and so reduce pedestrian injuries. Education courses are usually targeted at children and can include items such as: how to cross a road; concepts of speed; and traffic knowledge. They have been implemented in a variety of settings (home, school or traffic environments) and have been targeted either directly at children or at children with parents or teachers. Safety education programmes can increase safety knowledge and skills or behaviours among children (37-39). For instance in England and Scotland, use of the child pedestrian training programme Kerbcraft has been associated with an increase in road safety skills among those aged five to seven (38). Little is currently known about whether safety education programmes for child pedestrians can impact on accidents or injuries.

Child pedestrian training in England and Scotland: Kerbcraft

Kerbcraft is a road-side child pedestrian training programme designed for those aged five to seven. It teaches three road safety skills: recognising safe crossing places; crossing safely at parked cars; and crossing safely near junctions. Lessons are practical and are based in the road environment, allowing children the opportunity to practice new skills straight away. It is implemented over a period of 12 to 18 months and conducted by trained, local volunteers in the streets around the school. Kerbcraft has been piloted in 115 different locations across 75 local authorities in England and Scotland over a period of five years (www.kerbcraft.org).

2.3 Driver training / education programmes

Driver education programmes aim to increase the safety behaviours of drivers and reduce driver errors. Programmes may be provided one-to-one, within a group, or in the form of written materials (e.g. an information manual). They can be targeted at specialist groups such as those with a higher risk of accidents (e.g. those experiencing high numbers of crashes or offences), older people or novice drivers. They may also be offered to the general driving population in the form of advanced driving lessons. In the UK, national driver offender retraining schemes (see box) are commonly offered to drivers charged with road offences (e.g. speeding) as an alternative to licence penalty points or court appearances (40).

There is some evidence that driver education programmes can improve driving performance and knowledge (e.g. for older drivers [41]), as well as awareness of driving hazards (e.g. for novice drivers [42]). However, they appear to have little impact on RTAs. For instance, one systematic review explored remedial training (targeting those with poor previous driving records) and

advanced driver courses and could find no evidence of effectiveness for either type of programme in reducing traffic crashes or injuries (43).

National driver offender retraining scheme

The national driver offender retraining scheme is an education course commonly offered to drivers who have been charged with offences such as speeding, failing to stop at a red light or dangerous driving (40). Short education courses aim to increase safe driving skills through challenging why people drive dangerously, increasing awareness of the dangers involved and improving recognition of driving hazards. Some courses offer on-road driver tuition to correct bad habits and develop safe driving skills.

2.4 Media education campaigns

In the UK, media education campaigns have been used to increase knowledge, and change attitudes towards, a range of road safety behaviours using television, radio, and printed materials such as newspapers, posters and magazines. For instance, in England and Wales the Government's THINK! campaigns have promoted: road safety among children and older people; reducing driving speeds in both rural and urban areas; wearing seat belts; and using child restraints. Other campaigns have warned of the dangers and implications of drink driving, drug driving, driving when tired and using a mobile phone while driving (44). Similar campaigns have been run in Scotland through the Scottish Executive (e.g. drink and drug driving campaigns [45,46]). Although the impact of campaigns on behaviour and road traffic injuries is difficult to measure, some positive results have been reported. For instance:

- Following a Department for Transport campaign promoting the use of child seats and restraints and highlighting new

legislation on their use, 14% of people surveyed said they had bought or installed a child seat or restraint as a result of the campaign (47);

- After a Scottish drink driving campaign that used posters in bars and clubs, radio commercials, and bus and taxi advertising, two thirds of people surveyed about the campaign believed it would deter drinking and driving as well as encourage people to report those who drive while over the limit (48);
- Internationally, a review of media campaigns to reduce drink driving reported a median decrease in alcohol-related crashes of 13% following implementation (49).

3. Addressing drink driving

Along with education campaigns, other types of intervention have been implemented to reduce levels of drink driving in the community. These include bar server training programmes and designated driver programmes.

3.1 Bar server training programmes

Bar server training programmes train bar staff how to serve alcohol responsibly, with the intention of slowing patron drinking and preventing customers from becoming intoxicated. Since many people drive home after a night out, it is thought that responsible bar service can reduce levels of intoxicated driving and subsequently RTAs. Training courses include: education on the effects of alcohol; legislation; how to serve responsibly (e.g. eliminating price promotions, checking identification, offering food with drinks, helping customers to space drinks, refusing service to intoxicated customers and arranging taxis home for those that become intoxicated); and how to handle difficult situations such as violent customers. Bar server training

programmes can improve server behaviours (50,51) and reduce levels of customer intoxication when there is strong support from management (50,52). However, less is known about subsequent effects on RTAs or injuries. One US study reported an estimated 23% reduction in single-vehicle nighttime injury crashes following the use of mandated training for bar servers (53).

3.2 Designated driver programmes

Designated driver programmes promote the use of one person (within a group of friends) abstaining from alcohol during a night out and driving the other individuals home safely. Information on designated driver programmes are either disseminated through media campaigns or through initiatives based in nightlife settings that offer incentives (e.g. free soft drinks). As well as increasing safety behaviours, designated driver programmes may reinforce social norms against drinking and driving through the discussions and negotiations that take place about their use (54). There is insufficient evidence to determine their effectiveness (54). However, designated driver programs may create a number of inadvertent problems, such as greater than normal use of alcohol consumption by the other passengers (55) and drivers being distracted by drunken passengers (56).

4. Multi-component community interventions

Comprehensive interventions that engage the community at large and combine strategies such as education programmes and traffic calming measures can be effective in reducing the incidence of childhood pedestrian injury (57). Evaluations conducted in the US, Australia and Norway have reported reductions in pedestrian injury among children of between 12% and 54%. The greatest reductions in injuries were found in those projects that involved a wide variety of governmental and voluntary organisations in its implementation (57). In the UK, the

value of involving the community in developing and delivering road safety interventions, and strong partnership working between relevant agencies and organisations within the community, has been well recognised (58).

5. Enforcement of legislation

In the UK, there is a wide range of legislation relating to roads, vehicles and drivers that protect road users and pedestrians against accidents (see box on road safety legislation). The enforcement of such legislation is important, since it creates a stronger deterrent for committing road traffic offences. Evaluated enforcement activities have included the use of speed enforcement detection devices and policing for drink and drug driving.

5.1 Speed enforcement detection devices

Speed enforcement detection devices (e.g. speed cameras and laser and radar devices) can be effective in reducing traffic speeds and reducing the level of road traffic crashes, injuries and deaths in the vicinity of device sites (59,60). For instance, one systematic review of speed devices reported a reduction in road traffic injury crashes of between 8% and 46% in implemented areas (59). In rural areas, mobile speed cameras used on roads that experience high rates of accidents can reduce rates of accidents and crashes involving fatal or severe injuries (61).

5.2 Increased policing for drink and drug driving

The presence of police on the roads (and the threat of arrest) can act as a deterrent for people considering driving after drinking alcohol or taking drugs. In the UK, police have the power to stop and test drivers they suspect may be drink driving or taking drugs but not the power to conduct random checks. A

systematic review of interventions to increase police patrols for drink driving (and therefore the threat of arrest) found some evidence that they could have a beneficial effect on road traffic fatalities and crashes (62). However, often these types of initiatives are combined with other prevention activities such as public awareness campaigns or special training for officers, making it difficult to determine their effectiveness alone. There is less research available on increased policing for drug driving and it is not known whether the threat of arrest can reduce levels of drug driving or subsequent RTAs.

A related approach for drink driving is the use of police checkpoints that allow selective and random alcohol checks for drivers (known as sobriety check points). Although these are not permitted in the UK, they have been implemented in Australia and some European countries. A review of checkpoints for selective and random checks on drink driving reported median reductions in fatal and non-fatal injury crashes of 20% (selective checks) and 16% (random checks) (50).

Road safety legislation

In the UK, there is a wide range of legislation in place to protect road users and pedestrians from accidents and injuries. Legislation includes:

- Mandatory use of safety equipment (e.g. seat belts, motorcycle helmets);
- Prohibiting driving while under the influence of alcohol (over 0.08% blood alcohol concentration BAC) or drugs;
- Offences for dangerous driving (e.g. speeding or driving whilst using a phone);
- Requirement of regular safety checks on vehicles over three years of age;
- Safety standards for vehicle manufacturers and safety equipment.

Introduction of the Road Safety Act, 2006 and Motor Vehicle (Wearing of Seat Belt) Regulations, 2006 strengthened road safety legislation through the introduction of new offences (such as causing death by careless driving or driving without insurance) and tighter rules on existing laws (such as requiring all passengers to wear a seat belt if one is fitted, and requiring all children (aged less than 12) under 135 cm in height to use a child seat or booster seat when travelling in a car).

International variations on UK laws include:

Lower legal blood alcohol levels: Reducing the legal BAC limit (from 0.08% to 0.05% in the Netherlands, France and Australia, and from 0.05% to 0.02% in Sweden) reduced injury crashes (63);

Graduated Driver Licensing (GDL) schemes: GDL is an additional licensing phase between the provisional and full licences that allows the novice driver to gain more practical experience whilst at the same time reducing the risks of road collisions and injury. A systematic review of studies from Canada, the US and Australia reported a reduction in crash rates in the year after licensing of between 26% and 41% (64);

Raised minimum drinking age laws: A US review of drink driving interventions found that increasing the legal minimum drinking age (usually from 18 to 21) resulted in a decrease in alcohol-related crash outcomes of roughly 10% to 16% for the targeted age groups (50);

Compulsory use of helmets for cyclists: There is some evidence that a change in legislation to enforce use of helmets for cyclists can decrease levels of head injury rates in the targeted population (65). However in the UK, compulsory use has been heavily debated. Arguments against compulsory use include that it reduces the number of people cycling (66) and that cyclists (67) and drivers (68) may become less careful as a result of their use (risk compensation theory).

6. Summary

A wide range of interventions have been implemented and evaluated in the UK and other industrialised countries to increase road safety behaviours and to reduce RTAs and injuries. There is evidence for the effectiveness of the following interventions:

- Environmental adaptations to roads such as area-wide traffic calming interventions, marked pathways for cyclists and school crossing patrols. There is also evidence that safe routes to school initiatives can be effective, but this is based on research from US schemes that focused on environmental changes (UK schemes are often broader and include education programmes for children). There is a need for further research on the use of environmental changes in rural locations;
- Educational and promotional methods to encourage the use of safety equipment such as cycle helmets and car restraints for children;
- Bar server training programmes (although evidence is limited);

- Multi-component community interventions that combine different strategies and work with a variety of organisations;
- Speed enforcement detection devices; and
- Increased policing for drink driving.

In addition, although little is currently known about their impacts on injuries, safety education for child pedestrians and media road safety education campaigns can improve knowledge and safety behaviours among targeted audiences.

There is less evidence for the use of other road safety interventions. Driver training or education programmes can improve driver knowledge and perception of hazards but appears to have little effect on RTAs or associated injuries. There is insufficient evidence to determine the effectiveness of designated driver programmes, but some negative impacts have been reported (e.g. decreased concentration of drivers or increased alcohol consumption among those drinking), calling their use as a safety measure into question.

All references are included in the online version of this document, available from:

www.preventviolence.info and **www.cph.org.uk**

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