



childhood injuries

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 unintentional childhood injuries

Adapting the environment: Area-wide safety programmes (e.g. traffic calming measures) can reduce childhood injuries from road traffic accidents (RTAs). There is some evidence that school crossing patrols, safe routes to school initiatives, reducing the height of playground equipment and modifying playing surfaces can reduce injuries from road and sports/leisure accidents.

Provision and use of safety devices: The use of bicycle helmets, seat belts and booster seats can reduce injuries from RTAs, and residential pool fencing can prevent drowning. The use of protective sports equipment can protect against injuries for certain sports (e.g. helmets for cycling and cricket, goggles for lacrosse). The provision of home safety equipment (e.g. smoke alarms, stair gates or window locks) can improve safety behaviours but effects on injuries are unclear.

Safety education: Safety education for children and parents can increase awareness of injury, knowledge and safety behaviours. In general, effects on injuries are unclear. However, in some instances programmes have been successful. For instance, education programmes designed to increase the use of child restraints can reduce the risk of road traffic injuries.

Skills training: There is some evidence that training programmes for young sports players to develop co-ordination, strength and technique can prevent sports-related injuries and that formal swimming lessons can prevent drowning.

Multi-component interventions: Interventions that combine strategies (e.g. education programmes with traffic calming measures or provision of safety equipment) have been successful in reducing injuries and accidents (e.g. RTAs, falls and burns).

Unintentional injuries are one of the leading causes of morbidity and mortality in childhood and a significant public health concern in the UK. In 2008/09, there were over 95,000 hospital episodes for accidents among children aged 0-14 years (1) and over 200 deaths (2008 [2]). These represent only the most severe cases; many more are treated each year at accident and emergency (A&E) departments, walk-in centres, GP practices, or by parents and carers.

Childhood injuries: some facts

- The most common cause of hospital episodes for childhood unintentional injury (ages 0-14) is falls, accounting for around 45% of episodes (1);
- By contrast, the most common cause of death from an unintentional injury among those aged 0-14 years is from a road traffic accident (2);
- In a study of childhood deaths from injury in England and Wales, the rate of death for children of parents classified as never having worked or as long-term employed were compared with those classified as higher managerial or professional occupations. Rates were: 20.6 times higher for pedestrian deaths; 27.5 times higher for cyclist deaths; 37.7 times higher for fire-related deaths; and 32.6 times higher for deaths of undetermined assault (8).

Childhood accidents can take many forms. Some of the most common are those occurring in a road environment, as a pedestrian, cyclist or passenger in a vehicle. Accidents occurring in the home can include falls from stairs or windows, ingestion of medication or cleaning products, fires, contact with hot surfaces or liquids, and drowning in baths or residential pools or ponds. Other accidents can occur in leisure settings, such as falls in the playground, drowning in

public pools or injuries arising from playing sports such as football.

Certain groups of children experience injuries more often than others, including boys (2,3) and those living in deprived areas (4) or from a lower socio-economic background (5). Children living in poverty are far more likely to be killed or seriously injured than those from more affluent families and child injuries have some of the steepest social gradients for deaths compared with other causes (6).

The injuries sustained from childhood accidents can be wide ranging, including bruising, fractures, burns, spinal damage, brain damage and damage to other internal organs. While most injuries do not cause any lasting effects, a small percentage can result in permanent disability or even death (7). Children are more susceptible to accidents than adults, partly because the physical and cognitive skills needed to co-ordinate movements and recognise and respond to dangers are still developing (7).

The United Nations Convention on the Rights of the Child states that the child has the right to a safe environment and to protection from injuries and violence. Children and young people are a politically powerless group and need others to champion their cause in the prevention of injuries (6,7). The majority of childhood accidents are preventable, through changing the environment in which children live and play, encouraging the use of safety devices and protective equipment, the provision of education and skills training and strong legislation (see box). This document highlights interventions that have been put in place to prevent childhood injuries (amongst those aged 17 and under) and discusses their effectiveness. Interventions are split into three

main sections: road traffic injuries; injuries occurring within a home setting; and those occurring in a leisure setting.

Some examples of legislation to prevent childhood injury

Legislation has an important role to play in the prevention of childhood injuries in the home. This can include:

Laws on the use of safety devices, e.g: in the UK, until a child is aged 12 or 135cm in height, it is a legal requirement to use a child restraint or booster seat while travelling in a car. After this time, all individuals are required to wear a seat belt. Additionally, under the Smoke Detectors Act 1991, all new homes built are required to be fitted with smoke alarms.

Laws on the design of equipment, e.g: there is a wide range of British Standards for the manufacture of children's equipment and toys, including: pushchairs; prams; baby walkers; playpens; highchairs; and dummies. There is also a wide range of British Standards for the manufacture of sports, playground and recreational equipment. Under various legislative acts, it is illegal to sell a firework in the UK to anyone under the age of 18 and illegal for those under 18 to be in possession of a firework in a public place. With the exception of licensed suppliers, the sale of fireworks is also restricted to certain times of the year.

Laws on child-resistant packaging, e.g: regulations for child-resistant packaging for medicinal products have been in place in the UK since the mid 1970s. These require medicines such as aspirin and paracetamol to be packaged in child-resistant containers (applies to both reclosable and non-reclosable packaging). There is some evidence that child-resistant packaging can help prevent against poisoning fatalities among children (e.g. for aspirin [9]).

1. Road traffic injuries

1.1 Changes to the road environment

Traffic calming measures such as speed humps, reducing the width of roads, 20mph zones and speed cushions are designed to reduce traffic speeds and volumes in areas commonly used by pedestrians. Other safety measures include road closures (creating pedestrian zones), the provision of a central barrier in the road, separate pathways for cyclists and cars and prohibiting dangerous manoeuvres at accident hotspots, such as right hand turns. There is good evidence that area-wide road safety programmes are effective in reducing road traffic injuries and are of particular benefit to vulnerable road users such as child pedestrians and cyclists (6,10). 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 (10).

Further environmental measures include:

- *The use of school crossing patrols* in areas frequently used by child pedestrians (e.g. school routes). While evidence is generally lacking, there is some indication that they can reduce the number of accidents involving child pedestrians occurring at, or near, crossing sites (11);
- *Safe routes to school initiatives* that combine different measures to create safer routes to school for children. These include: better pavements; traffic calming measures; safe crossings for pedestrians and cyclists; traffic diversions (e.g. creating pedestrian zones); and sometimes safety education for children. 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 changes) can have positive effects on child pedestrian or cyclist accidents (12,13).

1.2 Use of safety devices

Safety devices can be used to prevent childhood injuries from road traffic accidents, including cycle helmets and child restraints such as booster seats and seat belts. While evaluations of cycle helmet use have been mixed (14), there is evidence that they can reduce the risk of head and brain injuries (15). The use of booster seats and seat belts among children can also reduce the risk of injury (16) and death (17). Booster seats are needed for smaller, younger children since they elevate the child to a level at which an adult seat belt is most effective.

1.3 Safety education programmes

Safety education programmes can be targeted at child pedestrians, child cyclists or parents with young children, and are designed to increase an individual's ability to cope with traffic environments as well as increase safety behaviours. In some cases, education programmes are combined with the provision of low-cost or free safety equipment (e.g. cycle helmets) to encourage their use.

Programmes for child pedestrians

Education programmes for child pedestrians include items such as: how to cross a road; concepts of speed; and traffic knowledge. They have been delivered in a variety of settings (home, school or semi-real traffic environments), and have

been targeted either directly at children or at children with parents or teachers. These programmes can improve knowledge and observed road crossing behaviours among children (18). However, it is unknown whether they can affect levels of pedestrian injuries. There is some evidence that pedestrian skills training that includes practical roadside experience leads to improved pedestrian crossing skills (19,20).

Programmes for child cyclists

Programmes for child cyclists are designed to increase safety knowledge (such as checking the safety of a bicycle, wearing appropriate clothing and equipment, and road safety), and skills (such as checking over the shoulder, signalling, and stopping and starting). In the UK, cycle proficiency courses (national standards for cycle training) are commonly provided free to primary school pupils via their local authority. There is some evidence that cyclist education can increase knowledge of safety behaviours such as wearing a cycle helmet (21). However, evaluations have been mixed with some showing no effects (22). The distribution of subsidised or free-of-charge helmets is often provided alongside educational programmes and this can encourage helmet use (23). Although research is lacking, there is some evidence that education programmes to encourage helmet use can reduce head injuries (24).

Educational programmes for cycle helmet use: an example

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. 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%. Furthermore, the rate of A&E attendance for cycle-related head injuries (aged <16) fell from 112.5 per 100,000 to 60.8 per 100,000 (24).

Programmes for parents with young children

A range of educational and promotional methods have been designed to increase the use of safety equipment such as seat belts, child restraints and child car seats (booster seats). They often include the provision of discounted or free safety equipment or incentives for their use. Education programmes combined with incentive schemes can increase levels of safety equipment use (e.g. booster seat use [25]). There is also some evidence that they can reduce the risk of injury (26). However, the impact of education-only programmes is mixed (25,26). In the UK, media education campaigns have been used to increase knowledge around safety behaviours (e.g. use of child restraints) with some success. For instance, following a Department for Transport campaign promoting the use of child seats and restraints, 14% of people who recognised the advertising said they had bought or installed a child seat or restraint as a result of the campaign (27).

1.4 Enforcement of legislation

Speed enforcement detection devices (e.g. speed cameras and laser and radar devices) can reduce traffic speeds and

the level of road traffic crashes, injuries and deaths in the vicinity of device sites (across all ages [28,29]). One systematic review of speed devices reported a reduction in road traffic injury crashes of between 8% and 46% in implemented areas (28). There is also good evidence for the use of enforcement campaigns in increasing the use of child car seats and general seat belt use, as well as decreasing levels of car occupant injuries and fatalities (26,30,31).

1.5 Multi-component interventions

Comprehensive interventions that engage the community at large and combine strategies such as education programmes and traffic calming measures can reduce the incidence of childhood pedestrian injury (32,33). Evaluations conducted in the US, Australia and Norway have reported reductions in child pedestrian injury of between 12% and 54%. The greatest reductions were found in those projects that involved a wide variety of governmental and voluntary organisations in its implementation (32). The use of multiple interventions, repeated in different forms and contexts, begins to develop a culture of safety within a community (33).

2. Injuries in the home setting

2.1 Provision and use of home safety devices

The provision and use of safety devices such as cupboard catches, stair guards, window locks, fire guards, electric socket covers, thermometers to test water temperatures, anti-scald devices in hot water taps and smoke alarms can offer protection against injuries occurring in the home. They

can be distributed free of charge, loaned, or offered at a reduced cost to households. Such schemes are often targeted at families living in disadvantaged areas. The provision of home safety devices is often combined with safety education programmes (see next section). However, they can also be used as stand-alone interventions.

The provision of home safety equipment can improve self-reported use of safety devices, but the impact on injury levels is inconclusive. One of the most evaluated initiatives is the free or discounted provision (and sometimes installation) of smoke alarms, which can lower the incidence of fire-related injuries (34). However, not all initiatives have been successful (35). Effects may depend on the number of smoke alarms distributed, installed and maintained over the study period (35). Smoke alarms can only offer protection if they are used and kept in good working order.

Safety devices that are sometimes used in the home to protect children from drowning are infant bath seats and plastic or metal fencing around residential pools or ponds. Infant bath seats are designed to support young children in a sitting position whilst in the bath. They are not sold as safety devices, but are often used as such by parents and caretakers. Their use has been debated. Increased feelings of security may encourage caretakers to leave young children unattended in water where drownings may occur (36). On the contrary, there is good evidence for the use of pool fencing in reducing the risk of drowning among children (37).

2.2 Safety education programmes

Safety education programmes teach individuals safety measures that can help them protect themselves and others

from a range of accidents and injuries (e.g. falls, burns, poisonings and drownings). While the content of programmes differ, they usually include information on the importance of using safety equipment (e.g. smoke alarms, stair guards and safety catches), safety behaviours (e.g. storing medicines and toxic substances safely or making a plan for an escape route in the event of a fire) and what to do in the event of an injury. Programmes are sometimes combined with the provision of safety devices (see section below) or home safety checks, and targeted at families with young children or those living in deprived areas.

Programmes can be clinical, home, school or community based:

- *Clinical-based programmes*: use one-to-one counselling by a GP, nurse or other health professional, or group-based education (e.g. parenting groups).
- *Home-based programmes*: use visits by a health or other professional to provide safety advice and home checks, often with free or discounted safety equipment and installation. Programmes can be attached to other schemes that provide regular home visits (e.g. Head Start, which provides home visits to parents living in deprived areas).
- *School-based programmes*: educate children about dangers in the home, safety behaviours and how to deal with accidents if they occur. A variety of methods are used, including role-playing, group work and written exercises. Some school-based programmes include homework to be completed with the wider family unit (36), which can be useful where it is difficult to reach parents directly.

- *Community-based programmes*: promote behaviour change at a community level through the use of media campaigns (e.g. through television, radio and newspapers). A more comprehensive intervention uses a multi-strategy approach that involves a range of local organisations. These programmes combine individual safety education and counselling with community-based media campaigns and other activities to promote safety behaviours.

Across all settings, there is good evidence for the effectiveness of safety education programmes in increasing safety behaviours and the use of some safety devices among families with young children (39,40). These include: functional smoke alarms (41); safe hot-tap water temperatures; safe storage of medicines and cleaning products; possession of syrup of ipecac (substance that can induce vomiting); numbers for poison control centres in easy reach; fitted stair gates; socket covers on unused sockets; and storing sharp objects out of reach (40). There is little available research examining impacts on subsequent accident or injury rates among children and effects are unclear. Programmes have more of an effect if they provide equipment alongside education sessions (40).

Some examples of safety education interventions in clinical and home settings

Clinical setting: In Nottingham, families from deprived areas with children under the age of five years were targeted with a safety education programme. Health visitors provided individual safety consultations in clinics or in the patient's home. At the same time, a range of safety equipment was offered and installed free of charge (e.g. stair gates, fire guards, smoke alarms, cupboard and window locks). Participating families were more likely to be safe in terms of: stairs; smoke alarms; windows; storage of cleaning products; and sharp objects in the kitchen one year later (compared to a control group). However, participation did not reduce levels of unintentional injuries that required medical attention (42).

Home setting: In the US, a home visiting safety education programme was provided to families of children attending the Head Start preschool programme (designed to improve child development). A case worker assessed home hazards and provided families with safety information and equipment where needed (e.g. smoke alarms). Participation was associated with greater possession of: a working smoke alarm; syrup of ipecac; and an age appropriate booster seat for the car (43).

Some examples of safety education interventions in school and community settings

School setting: In Nottingham, Risk Watch was delivered to children aged seven to 10 (school years three to five). Age appropriate lessons and activities were provided by teachers, covering topics such as falls, poisoning, fire and burns. Two to five months later, participating children had better knowledge of some preventative actions (e.g. knew what to do in a house fire or upon finding tablets) than controls. While there were no major changes in safety behaviours, participants were more likely to report never playing with matches and could demonstrate correct procedures if clothing caught fire (44).

Community setting: In Norway, a community programme to reduce burns was implemented over a period of 10 years. A number of strategies were used, including individual counselling and media campaigns. Activities included the promotion of: lower tap water temperatures; the purchase and installation of cooker safeguards; the availability of cooker safeguards in stores selling electric stoves; parental vigilance in burn-risk situations; and parental skills in giving first aid. In addition, child safety was promoted generally through local private and public organisations and the media. Long-term evaluation of the programme found that it had prevented the most serious burns among children caused by stove and tap injuries (45).

3. Injuries in leisure settings

3.1 *Modifying the environment*

Modifying the environment in which children play can offer some protection against childhood injuries. For young children, reducing the height of play equipment and increasing the depth of impact-absorbing surfaces around equipment appears to reduce overall rates of injury (46). For

water-related accidents, the provision of lifeguards around swimming pools and natural bodies of water can provide protection against children drowning, although there is little formal evaluation of their use (7).

3.2 Use of protective or safety equipment for sports and leisure activities

For some sports and leisure activities, the use of protective equipment can reduce the risk of experiencing an injury. These are designed to protect against direct blows to the body (e.g. during contact or ball sports), to support or protect muscles, joints and other areas of the body while a person is active, or to protect against drowning. Equipment can include:

- *Helmets*: The use of helmets when cycling can reduce the risk of head, brain and severe brain injury by between 63% and 88% (across all ages, including children [13]). Among child cricketers, helmet use can reduce head, neck and facial injuries (47);
- *Eye goggles*: Although evidence is limited (48), protective eyewear can be effective in reducing head and face injuries in some sports (e.g. for lacrosse players [49]);
- *Ankle or knee braces*: Among adults, the use of ankle braces can reduce ankle sporting injuries (50,51), but the effects of using knee braces is unclear (52,53). Less is known about their use among adolescents engaged in sports and evidence is inconclusive (48);
- *Mouthguards*: Mouthguards can offer significant protection against orofacial or dental injuries for certain sports (54,55). One review of studies reported an overall

risk of an orofacial injury of between 1.6 and 1.9 times higher when a mouthguard is not worn (across all ages [54]);

- *Safety balls*: For ball games such as cricket, the use of softer balls for children may offer some protection against head or other injuries. Although there have been no evaluations in the UK, in the US, the use of softer baseballs (known as safety baseballs) have been found to have less potential for injury than standard balls (56) and have been associated with a 23% reduction in ball-related injury (57);
- *Personal floatation devices*: Personal floatation devices such as lifejackets are common protective devices used for sports and leisure activities on the water, particularly for children who may lack the ability to swim. Few academic studies have examined their effectiveness in preventing drowning, but studies of drowning deaths suggest they are associated with not wearing a floatation device (58);
- *Pool fencing*: For private swimming pools and spas that may not be staffed by a lifeguard, metal or plastic fencing around pools/pool areas can be effective in reducing levels of drownings (37).

3.3 Water safety education programmes

Water safety education programmes target either children or parents and aim to heighten awareness about the dangers of water. Although evidence is limited, education for children can increase water safety knowledge and attitudes (59). However, positive effects are only apparent for younger children (ages five to seven), with less benefits reported for

older individuals (ages seven to 15 [59]). Education can also improve parental attitudes. For instance, in New Zealand, a toddler water safety programme for parents was associated with: increased parental awareness of the dangers of unsupervised swimming pools; less belief that swimming lessons were the best way to protect their children from drowning; and greater belief that their toddler required more (not less) supervision after swimming lessons (60). In the UK, there have been a variety of local media campaigns to increase child and parental knowledge of water safety, including aspects such as: the dangers of swimming in open water; dangers of playing on ice; recognising potential dangers; and what to do in an emergency. However, their effectiveness has not been measured.

3.4 Training for sports and other leisure activities

For young people participating in sports, training programmes have been used to improve co-ordination, strength and technique, as well as increase awareness of injury risks and prevention strategies. Programmes can include a variety of components, such as: muscle group training; flexibility; weight training; cardiovascular exercise; technique improvement (e.g. how to jump, land or fall safely); and training in the proper use of equipment. In general, studies of training programmes among adolescents report moderate, positive effects on the rate of subsequent sports injury (48).

The provision of swimming lessons in childhood is commonly used to help protect children from drowning. Although swimming lessons are known to improve swimming ability, there is some debate about their effectiveness in

reducing drowning. This is because skilled swimmers may be more likely to participate in water activities and to take more risks (e.g. swim in deeper waters) than those with less ability. However, while there is as yet no conclusive evidence, some studies suggest that formal swimming lessons may reduce the risk of childhood drowning (61).

4. Summary

Societies have a responsibility to protect children and young people and to provide safe environments for them at home, at play and leisure, and on the roads (62). A wide range of interventions have been implemented to prevent childhood injuries.

For **road traffic accidents**, successful interventions for reducing injuries include:

- The use of area-wide safety programmes (e.g. traffic calming measures);
- The use of school crossing patrols (although evidence is limited);
- The use of safety devices such as bicycle helmets, seat belts and booster seats;
- Enforcement of speed legislation;
- Safety education programmes for parents (e.g. to increase the use of child restraints);
- Multi-component interventions (e.g. combine education with traffic calming measures);

Safety education for children has also been associated with increased knowledge and safety behaviours.

For **injuries in the home setting**, successful interventions for reducing injuries include:

- The provision of smoke alarms (however, effectiveness depends on regular use and maintenance of alarms);
- Residential pool fencing.

Other interventions have been associated with increases in safety behaviours, including:

- The provision and use of other home safety devices (e.g. cupboard catches, window locks, stair guards);
- Safety education programmes (sometimes combined with provision of home safety devices).

The use of infant bath seats may encourage parents to leave children unattended in the water and are not recommended as a safety measure.

For **sports and leisure injuries**, successful interventions to reduce injuries have included:

- Reducing the height of playground equipment;
- Modifying playing surfaces;
- The use of some protective sports equipment (e.g. helmets for cycling and cricket, goggles for lacrosse);
- The use of skills training programmes for young sports players;
- Formal swimming lessons (although evidence is limited).

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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