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Effective Health Care

Bulletin on the effectiveness of health service interventions for decision makers

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Preventing unintentional injuries in children and young adolescents

- A Health of the Nation target is to reduce by one third the death rate from unintentional injury in children aged 14 and under by the year 2005.
- There is good evidence that the use of cycle helmets and child car seat restraints can reduce serious injury to children involved in road traffic accidents.
- Urban road safety measures such as the provision of crossing patrollers, measures to redistribute traffic and improve the safety of individual roads can reduce the rate and severity of childhood accidents.
- The use of safety devices in the home such as smoke detectors, child resistant containers and thermostat control for tap water can reduce the risks of home injuries. Targeting of households at higher risk combined with home visits, education and the free distribution of devices is likely to make the most impact.
- Educational programmes by themselves appear to have little effect. However, a number of community programmes which involve local participation and use a broad range of interventions have been effective at reducing childhood injuries from a wide variety of causes. These need to be based on accurate data derived from surveillance systems.

A. Unintentional injury in young people

In 1992 in England and Wales, 563 children under the age of 15 died as a result of an unintentional injury.[1] Nearly half the children died in traffic accidents, 15% by fire and flames, 8% by drownings and submersions, and 7% each by mechanical suffocation and falls. Most of the unintentional injury deaths in children under 5 years old take place in the home.[2] Children of poorer families are at higher risk of road traffic accident and unintentional injuries in the home.[3]

In 1990, injury and poisoning accounted for 24% of deaths in children between the ages of 1 and 4 rising to 37% for children aged 5–9 and 39% for children aged 10–14.[4]

In 1992, the annual cost to the NHS of unintentional injury in childhood and young adolescence in England and Wales was estimated at £200 million.[5]
The prevention of unintentional injury was identified as a key area in the Health of the Nation document.[6] The target was to reduce the death rate for the 0 –14 age group by one third by the year 2005.

This bulletin summarises the results of a systematic review of research evaluating the effectiveness of methods of preventing unintentional injuries in young people.

The last week of June 1996 is 'Child Safety Week' and the Child Accident Prevention Trust has produced complementary guidance which has been written for purchasers to assist in the specification of relevant effective services within contracts. A recent review has summarised the literature on the effectiveness of interventions in reducing accidental injury in the 15-24 years age range.[7]

B. Evaluating interventions aimed at preventing unintentional injuries in young people

Searching the literature:

The relevant literature was identified by a search of computerised databases (the database of primary studies of childhood injury prevention at the Department of Child Health, University of Newcastle Upon Tyne, BIDS, MEDLINE, EXCERPTA MEDICA, the DHSS database and the Social Science Research Index). Reference lists

Table 1 The road environment

Author, date and country	Injury target group and setting	Aims and content of intervention	Study type and sample size	Outcome measures	Key results
Boxall (1988)[22] UK	4-11 years Road policy	Following difficulties of filling vacancies for crossing patrols at schools, accidents were compared at staffed and different types of unstaffed sites near schools: I = operational sites C1 = sites where criteria were not met for crossing C2 = sites where staff could not be recruited C3 = other sites	Controlled trial I = 69 staffed sites C1 = 15 C2 = 18 C3 = 10	Road traffic accidents at or near sites	At 69 staffed sites 8 accidents (1 reported by crossing patrol) in 5 year period Reduced accident rates were reported for staffed sites
Walker & Gardner (1989)[94] Nelson	General population children	*Urban safety project* I = Package of engineering measures individually targeted to local conditions.	Controlled study Before and after observations in each of 5 cities. Intervention area and control area selected.	Police stats 19 data. Road traffic casualties.	Accident Reduction 7% Accident reduction 14%
Walker & McFetridge (1989)[95] Bradford	General population	Measures to redistribute traffic and improve safety of individual roads C = Areas with similar accident and network characteristics in which 'normal remedial' work continued			Initially, increase in accidents, modifications made. Accident reduction 4-15%
Ward et al (1989)[96] Reading	General population				Accident reduction 20-32% Pedestrian injuries reduced
Ward et al (1989)[97] Sheffield	General population				Estimated reduction 10-25%
Ward et al (1989)[98] Bristol	General population				
UK	Community-wide				

of other literature reviews in the field were scanned[8-14] as were the reference lists of important books and articles.[15-18] Relevant journals were hand searched and key researchers in the field were contacted.
The main criteria for inclusion of studies were that they related solely or in part to the prevention of unintentional injuries in children and adolescents aged between 0 and 14; described measures designed to prevent accidents or reduce the impact of accidents; evaluated an injury prevention intervention and described some outcome measure.

Areas considered in this bulletin are the road environment, the home environment, the leisure environment and community-based campaigns.

Assessing the quality of evidence of the studies:

The NHS Centre for Reviews and Dissemination review guidelines were used.[19] Two reviewers extracted the data from each study using a standard form. A hierarchy of evidence based on study design (which classifies good RCTs as the most reliable) was used to judge the degree to which studies were susceptible to bias. Within each type of study design 3 reviewers independently assessed the quality of evidence for each of the studies.

A total of 141 evaluation studies were identified. For each category of intervention only those studies which used a controlled trial or time series analysis design to evaluate the intervention and which were rated as of good quality (49 studies) were summarised in the Tables. Details of all the studies are available from the Health Education Authority.

C. The road environment

C.1 Area-wide urban safety measures

Land use and transport policies have a significant impact on children's use of the road environment both for play and moving from place to place. These policies also affect the volume and speed of traffic. For example, because the risk of pedestrian injury is more likely to occur with a car journey than one by bus, policies which promote the use of public transport may help reduce road traffic accidents.[20] Housing policy is also relevant because streets of Victorian terraced houses with little play area and on- street parking are associated with higher rates of accident casualties.[21]

A controlled trial in the UK found that the provision of crossing patrollers reduced the rate of accidents compared to sites where staff could not be recruited and other non-patrolled sites.[22]

In the Urban Safety Project the effect of measures to redistribute traffic and improve the safety of individual roads was assessed in 5 English towns compared to matched control areas.[23] There was an overall accident reduction of 13% attributable to the schemes but there were great variations between schemes. Slight accidents declined proportionately more than serious ones. Measures that were particularly successful were those which protected two wheeled vehicles (such as right turn prohibition and central road dividers) and there was a general reduction in child cyclist casualties. Each scheme cost about £250,000 and first year rates of return indicated considerable accident cost savings.[24] See Table 1.

C.2 Road safety aimed at the driver

The speed at which a car is driven affects the severity of pedestrian injuries (20mph leads to 5% deaths; 30mph - 45%; 40 mph - 85%). Therefore transport policies aimed at reducing excessive car speed such as traffic calming may be effective. However, there are very few evaluations of such interventions. See Table 2.

Table 2 The road environment - road safety education - drivers

Author, date and country	Injury target group and setting	Aims and content of intervention	Study type and sample size	Outcome measures	Key results
Janssen (1991)[99] Netherlands	General population Community-wide	Package of engineering measures, 3 options of combined measures (1) very simple measures to exclude through traffic (2) more extensive measures to exclude most local traffic and reduce speeds (3) Woonerf model - complete reconstruction of pedestrian priority areas C = no intervention	Controlled trial	Accidental injuries (data collected over 15 year period)	Reduction of 25% of accidental injuries. Most expensive option on Woonerf model (3) not as effective as speed limiting option (2)

C. 3 Road safety education aimed at the child

Road safety education: There is little reliable evidence to suggest that children can be successfully trained to avoid injury on the roads. Controlled trials indicate that teaching children road crossing skills can change reported behaviour and that instruction in the classroom can be as effective as at the roadside.[25-27] See Table 3.

Based on these experimental studies, the 'Let's Decide Walk Wise' programme has been developed in the UK. This school based pedestrian training resource for 5-8 year olds has practical sessions in the road environment, work using table top models and curriculum work in the classroom. Children in participating schools did better in tests than controls,[28] a finding in common with similar programmes in Australia.[29] However, a small randomised controlled trial in the Netherlands found that both theory and practical training of young cyclists to behave properly at road intersections had little effect.[30]

Traffic clubs: Five studies of good quality were identified, all based in the UK. An assessment of the US-based 'Tufty Club' in Lancashire found no evidence that children's knowledge of road safety had been improved.[31] The 'Streetwise Kids Club' was introduced in London, but membership was low, particularly in lower social class groups.[32] More recently, an evaluation of the 'Eastern Region Traffic Club'[33] showed increased participation and a positive effect on aspects of behaviour[34] and a 20% reduction in casualties involving children emerging from behind a vehicle.[35]

C.4 Cycle helmets

In 1992, 35 children under the age of 15 were killed in England and Wales as a result of pedal cycle collisions with motor vehicles; nearly 1,000 were seriously injured and over 5,000 slightly injured. At least two thirds of cyclists killed in accidents had head injuries which contributed to death.[36]

Two reviews have examined the case for wearing cycle helmets.[36,37] Several surveys and epidemiological studies have reported that cyclists who wear helmets have a reduced risk of severe head injuries. These are difficult to interpret however, because people who wear helmets are likely to be more cautious and so have fewer, or less serious, accidents[38] and the effectiveness of their use is controversial.[39] The only reliable way of assessing the impact of wearing a helmet is to assess the effect of programmes which increase the use of helmets on injury rates.

One major evaluation of the effect of community wide programmes to promote the wearing of cycle helmets showed a significant reduction in the rate and severity of casualties. In 1990, following 10 years of cycle helmet promotion campaigns, the State of Victoria in Australia introduced the first law in the world requiring cyclists to wear helmets.[40,41] The increase of helmet wearing rates from 31% immediately before to 75% in the year following legislation was associated with a 48% reduction in head injury admissions or deaths between 1989/90 and 1990/91 and a reduction of 70% over the 2 year period 1989/90 - 1991/2. Some of this reduction is explicable by a small decrease in cycling activity in some groups (particularly teenagers).[42] However, the reduction in non-head injuries was only 23% in the first year and 28% over the first 2 years. So it is likely that at least half of the observed head injury reduction was due to the increased wearing of helmets.[43,44] See Table 4.

A number of studies have attempted to evaluate the effectiveness of educational programmes to increase the use of cycle helmets. These programmes involved use of the media, alliances of several organisations and sectors, and subsidies to reduce the cost of helmets. Most of these studies show increases in the wearing of helmets. However, the quality of the studies was generally quite low and it is difficult to attribute change to the campaign since the control groups were often not sufficiently comparable or because there were no controls.[45-48] A RCT of hospital based counselling after an accident found a small reported increase in helmet wearing but was too small to show statistical significance.[49,50]

The cost of helmets may be an obstacle to voluntary use. A RCT in Canada reported a significant increase in helmet use in a school based educational programme which included a discount scheme compared to education by itself. Programmes which do not take into account the costs of helmets may result in differential uptake in children.[51]

As with seatbelt legislation, the experience in Victoria has shown that legislation following education campaigns can increase use. This is confirmed by results following the passage of the first bicycle helmet law in Howard County, USA. This

Table 3 The road environment - road safety education - children

Author, date and country	Injury target group and setting	Aims and content of intervention	Study type and sample size	Outcome measures	Key results
Ampofo-Boateng et al (1992)[26] UK	5-11 years School	Group training to find safe places to cross: comparison of roadside and classroom training. I1 = tabletop model in a school classroom I2 = trained in the real traffic environment	Before and after study with randomly selected groups I1 = 8 I2 = 8 C = 40 (A previous study provided the control group data)	Reported behaviour	Roadside and classroom training equally effective. More safe routes selected by trained groups. Deterioration in short term but trained groups still better than untrained groups 8 months after the programme ended
Antaki et al (1986)[31] UK	5 years School	I = school based road safety education using Tufty materials C = non-Tufty materials	Controlled trial I = 13 schools C = 18 schools	Knowledge	All children improved test scores over the 6 months' period,however children exposed to Tufty mat'ls performed no better at the post test than non-intervention group
Bryan-Brown (1994)[34] UK	3.5 -4 years Home	Children's Traffic Club I = children invited to join club on 3rd birthday. Parents receive mailed age-appropriate booklets to teach road safety knowledge & behaviour & encourage supervision C = no intervention	Controlled trial survey 1 I = 500 C = 500 Survey 2 I = 200	Reported behaviour Attitudes Knowledge of children and carers	Club membership varied from 50% to 37% in different counties. Members reported a reduction in children playing in the streets , an increase in carers' holding child's hand on pavement, and in promotion of children stopping when told and increase in road safety education. Non members watched local safety programmes on TV with child more
Bryan-Brown (1995)[35] UK	3-5 years Home	Children's Traffic Club I = all intervention children invited to join club on 3rd birthday. Parents receive mailed age-appropriate booklets to teach road safety knowledge & behaviour & encourage supervision C = no intervention	Controlled trial I = 7 counties (81,000(chidren joined club C = 6 counties	Mortality data Morbidity data (Police Stats 19)	In 2 years of free scheme 81,000 children in I area joined club (50% population 3 year olds) 20% reduction in casualties involving children emerging from behind a vehicle Other reductions between I & C areas observed but not stat. sig.
Downing et al (1981)[100] UK	3-3.5years Home	Children's Traffic Club Booklet produced for parents to assist in teaching young children road safety & encourage appropriate levels of supervision	Randomised controlled trial I=1560	Reported behaviour Knowledge	Small increase in knowledge in parents who received booklets. Mothers receiving booklets more likely to teach children about road safety (70%) compared to 50% in last 8 weeks No effect on behaviour. Materials well received by parents & children
Harland & Tucker (1994)[28] UK	5-8 years School	"Lets decide Walk Wise" Programme I = pedestrian training resource used in primary schools integrated into the curriculum. Six practical sessions in local road environment and classroom training using table top models (Ampofo Boateng et al 1992). Training by teachers and parent volunteers C = no intervention	Controlled trial I= 8 schools (sample 127 tested) C= 3 schools (sample 69 tested)	Observed behaviour Knowledge Attitudes	In I schools more children selected safe routes on table-top models. Differences were more marked in more "compliant" vs. less "compliant" schools. In the highly compliant schools the proportion of safe crossing places selected by pupils increased from 0.56 to 0.84. Materials well received by teachers.
Penna (1994)[29] Australia	8-10 years School Community-wide	'Streets Ahead' School based traffic safety education programme. I = integration of curricular activities & real traffic experience. Delivered by teachers C = no intervention	Controlled trial I = 649 C = 539 9 schools in each	Observed behaviour Reported behaviour Attitudes Knowledge	Small improvement in attitude scores in 8 of 9 I schools compared to C 4 of 9 I schools showed increased knowledge scores compared to C No change in children's crossing behaviour. Two schools showed improved behaviour 10-15% (These schools practised crossing behaviour at 'real' sites to greater extent)
Thomson et al (1992)[25] UK	5 years School	Group training in skills to find safe places to cross: I1 = roadside training, six half hour long sessions I2 = classroom training using a table top model, six half hour long sessions. C = no intervention	Randomised controlled trial I1 = 10 I2 = 10 C = 10	Reported behaviour and knowledge	No difference in 2 training methods. Roadside and classroom training resulted in significant improvements. Increase from 10-30% in safe crossing skills retained over 2 month period
Tucker (1992)[101] UK	3-5 years Home	Children's Traffic Club Parents of pre-school children invited to join traffic club. Road safety knowledge and behaviour taught by parents	Controlled trial I = 7 counties in Eastern Region C = 6 counties	Knowledge Reported behaviour Awareness	Club membership at 49% of relevant age group. Claims some improvements in reported behaviour amongst traffic club members - 16% reported stopping at kerb compared to 4% of non-members
van Schagen (1988)[27] Netherlands	5-9 years	I = one to one training in timing skills at the road side C = no intervention	Controlled trial I = 26 C = 47	Reported behaviour	Improvements in skills of children reported
Van Schagen & Brookhuis (1994)[30] Netherlands	8-9 years School 3-5 years	Training methods to teach young cyclists to behave correctly in interaction with other traffic at intersections I1 theory & traffic training ground instruction I2 training ground instruction C = no intervention	Randomised controlled trial I1 =17 I2 =17 C = 15	Observed behaviour Knowledge	Neither of 2 training approaches successful in improving priority decisions of young cyclists but some positive effect on signalling and visual search behaviour
West et al (1993)[33] UK	Home	Children's Traffic Club I = children invited to join club on 3rd birthday. Parents received mailed age-appropriate booklets to teach road safety knowledge & behaviour & encourage supervision C = no intervention	Controlled trial survey 1 I = 459 C=573 respondents Survey 2 I = 799 C=802 respondents	Reported behaviour Attitudes Knowledge	Traffic Club seemed to have little effect on children's knowledge or reported behaviour, except for reducing incidence of children running on ahead of parents when out walking. No effect on whether children crossed road alone, played unsupervised in street or rode bicycles unsupervised Materials favourably received.

Table 4 The road environment - cycle helmets

Author, date and country	Injury target group and setting	Aims and content of intervention	Study type and sample size	Outcome measures	Key results
Cushman et al (a) (1991)[49] Canada Cushman et al (b) (1991)[50] Canada	5-18 years Primary health care	I = hospital based counselling by physicians following injury. One short counselling session and education about cycle helmet use C = usual care	Randomised controlled trial (children attending hospital after bicycling accident) I = 167 families C = 172 families	Reported purchase/use of helmets	Small reported increases in helmet wearing by intervention and control group (not significant)
Dannenberg et al (1993)[52] USA Coté et al (1992)[103] USA	Under 16 years, middle class, rural and suburban All children, general population, community-wide	First helmet law in USA Comparison of: I1 = bicycle helmet legislation (for under 16 year olds) and educational campaign I2 = educational campaign C = no specific campaigns	Controlled trial. Surveys to students in random sample of schools in 3 counties (approx 2000 in each area)	Reported behaviour Attitudes Knowledge Observed helmet use rates	Self reported helmet used in legislation county rose from 11% to 38% after legislation, in education county from 8% to 13% and in comparison county from 7% to 11%. Significant increases in helmet wearing rates post legislation in intervention community. For children increases from 4-47%.
Leicester et al (1991)[40] Cameron et al (1992)[41] Finch et al (1992)[104] Finch et al (1993)[42] Vulcan et al (1992)[105] Cameron et al (1994)[44] McDermott (1995)[43] Australia	General population cyclists in Victoria Children 5-11 years Teenages 12-17 years Adults 18+ years Community-wide	VICTORIA, AUSTRALIA First state to introduce legislation in the world Decade of health promotion to increase helmet use preceding legislation in July 1990 Multi-faceted campaign inlcuded Bike-Ed, school campaign for children 9-11 years, bulk helmet purchase schemes, mass media publicity; efforts to improve helmet design and wide consultation. Enforcement of legislation penalties.	Time series of observational studies 1) bicycle exposure 2) helmet wearing (sample sizes ranged from approx 1,500 to 11,000) Monitoring of insurance claims and hospital data	TAC Insurance Data Hospital mortality and morbidity Observed behaviour of bicycle use and correct helmet wearing	1) Helmet wearing rates in Victoria rose from 5% in 1982/83 to 31% in 1989/90 to 75% in 1991 following law introduction 2) In Melbourne Following legislation there was no reduction in adult cyclist exposure, moderate effect on children (10% less cyclists observed) and major effect on teenager (decrease by 46% compared to 1990) 3) In Victoria there was a reduction of 48% in head injured admissions or deaths between 1989/90 and 1990/91 and 70% between 1989/90 and 1991/92. (Also a reduction in non-head injuries of 23% between 1989/90 and 1990/91 and of 28% between 1989/90 and 1991/92.)
Morris et al (1991)[102] Canada	Elementary school children School	School based programme: I1= education only I2 = education and opportunity to purchase bicycle helmet at a discount price C = no intervention	Randomised controlled trial (by school) 450-700 children at each school	Observed helmet use, helmet sales	No increases in helmet wearing at control and education only schools. Discounts + education only schools. Discounts + education led to an increase from 1-22% pre and post programme (sig)

showed that self-reported helmet use rose from 11% to 38% after legislation in conjunction with an educational campaign, compared to a smaller increase from 8% to 13% in a county where there had been education only, and from 7% to 11% in a county with neither legislation nor education.[52]

A study using USA data attempted to model the relative cost-effectiveness of 3 approaches to increasing helmet use - legislative, community-based and school-based.[53] It was assumed that those not wearing helmets have a 6.7 times greater risk of a bicycle-related head injury, a difference sustained for

Table 5 The road environment - child restraint and seat belt use

Author, date and country	Injury target group and setting	Aims and content of intervention	Study type and sample size	Outcome measures	Key results
Agran et al (1987)[54] USA	Under 4 years Community-wide	Evaluation of child restraint laws for under-4s in state of California I = under 4's C = 4 - 14 year olds (who are not covered by the child safety law)	Before and after study with comparison groups I = 515 C = 1104	Reported restraint use, hospital attendance, Coroners' reports, injury severity	Increase in reported restraint use from 26-50%. Decrease in injuries but no decrease in attendance at hospital
Chang et al (1985)[59] USA	Pre-school, day care centres and nursery schools	*'Buckle Bear'* programme I = educational programme for pre-school children to increase safety seat and belt use and to use back seat of car. Training workshops with teachers, parent meetings, classroom lessons, films & puppets. C = no intervention	Controlled trial (intervention & control groups carefully matched on baseline risk factors) I = 6 sites (402 children) C = 7 sites (427 children)	Observed behaviour Children's knowledge Simulated practice	Children in experimental sites increased their use of safety seats or seat belts from 21.9% to 44.3%. Control same throughout Children also increased their knowledge and simulated practice (placing dolls in safe location in back of a toy car).

Table 5 continued

Author, date and country	Injury target group and setting	Aims and content of intervention	Study type and sample size	Outcome measures	Key results
Christian & Bullimore (1989) [54b] UK	Rear seat occupants following road traffic accident and attending an accident & emergency dept. in E. Berkshire 70% of restrained and 25% of unrestrained were <10 years	To assess the effect of seat restraints in rear passengers in reducing injuries.	Prospective comparison of 441 rear seat occupants seen following road traffic accident. 411 restrained 30 unrestrained	Injury Severity Score Deaths	The Injury Severity Score was lower among restrained subjects (p=0.0001). This was also true for the subsets of children up to 5 years, 6-10 years and 11-15 years. All 11 deaths were in unrestrained subjects.
Christopherson et al (1982)[60] USA	0-1 years (infant mother pairs) Primary health care	I = free loan of seat and demonstration of correct use C = usual care	Randomised controlled trial I = 15 infant mother pairs C = 15 infant mother pairs	Observed correct use of restraint at discharge and 4-6 months	Correct restraint use in intervention group 67% at discharge, controls 0% correct use at discharge. No sig. differences at 4-6 months
Goodson et al (1985)[57] USA	Infants 0-6 months Primary health care	I = prenatal child safety education targeted at parents to increase use of infant restraint seats (video + advice). Half hour programme C = ususal pre-natal course	Randomised controlled trial I = 78 C = 58	(Telephone survey) Reported restraint use at 4-6 months	(2 hospitals) intervention groups reported restraint use at 96% and 94% as compared with 78% and 60% in the control groups
Jarmark et al (1988)[61] Sweden	Under 2 years Primary health care	I = free loan of seats to all parents in Swedish community for infants 0-9 months C = no intervention	Controlled trial (2 counties) I = 771 C = 710	Reported behaviour	At 6 months in I 83% reported use of car restraints, 15% use of carry cots, 2% other restraints. In C after 6 months 28% reported using car restraint, 66% carry cots and 6% other restraints. At 18 months 98% of I and 95% of C were using child car restraints.
Miller & Pless (1977)[106] USA	Children 1-17 years (mean 4 years) Primary care	I = educational interventions in paediatrician's office to increase wearing of seat restraints: 3 types of instruction I_1 = pamphlet alone I_2 = pamphlet + verbal instruction I_3 = pamphlet, verbal instruction + tape-slide show C = no intervention	Randomised controlled trial I1 = 82 I2 = 99 I3 = 215 C = 221	Reported behaviour	2 weeks after the intervetnion, no statistically significant changes in behvaiour in any of the groups Greatest increase reported in control group
Reisinger et al (1981)[58] USA	Infants 0-15 months Primary health care	I = education at well child visit & targetted discussion by paediatricians with demonstation of correct use of restraints C = customary education with no mention of protecting infants in cars	Randomised controlled trial I = 127 C = 142	Observed restraint use at 1,2,4 and 15 months	Correct use of restraints in the intervention group was higher at all observation points, by 23% at 1 month, 72% at 2 months, 9% at 4 months and 12% at 15 months
Williams & Wells (1981) [55a] USA	Under 4 years Community wide	Evaluation of child vehicle restraint law for under-4s in the State of Tennessee. C = no child vehicle restraint law	Before after study with area controls. 2 intervention towns (1,108 child passengers) 2 control towns (1,003 child passengers)	Use of child restraints anchored by seat belts. Travel in arms (not forbidden by law).	Use increased from 8% before law to 29% in third year, compared to 11% to 14% in control area. Travel in arms stayed the same in both areas

4 years, with 65.9 years of life saved for every death prevented. The study reported that legislation and community-based programmes cost approximately $37,000 per head injury avoided compared to school-based ($144,000). However, because of the relatively low number of potentially fatal injuries to cyclists, the cost per life year saved is considerably higher at around $935,000.

C. 5 Car restraints

There is considerable evidence that child car seat restraints (for young children) when properly used, reduce car occupant injuries.[54a,b] As with cycle helmets, two broad strategies, legislation, and promotion campaigns, have been evaluated. See Table 5.

Studies of the effect of legislation for the under 4s in the USA generally report moderate increases in restraint use[55a] and reductions in injuries and deaths.[55b] Compliance with the

Table 6 The home environment - prevention of general home accidents

Author, date and country	Injury target group and setting	Aims and content of intervention	Study type and sample size	Outcome measures	Key results
Colver et al (1982)[66] UK	Under 5 years Low socio-economic area Home Community-wide	Play it Safe: I1 = families told about campaign and sent a reminder I2 = families received a copy of the campaign booklet, physicial hazards in the home were assessed and advice given on how to reduce hazards	Randomised controlled trial (clinics, nurseries) I1 = 43 families I2= 37 families C = 150 families	Observed behaviour	60% of I$_B$ made some physical change to make their homes safe as compared with 9% of I$_A$ No difference between intervention and control groups in terms of observed hazards. Some evidence of safety proofing in intervention group (70% made at least one change)
Dershewitz et al (1977)[67] USA	Under 5 years Primary health care	I = 20 minute personalised counselling, literature on prevention of injuries. Outlet covers and door catches provided free and household hazard assessment C = household hazard assessment	Randomised controlled trial I = 101 C = 104	Observed behaviour, attitudes and knowledge	No difference between intervention and control groups in terms of observed hazards. Some evidence of safety proofing in intervention group (70% made at least one change)
Dershewitz (1979)[68] USA	Under 5 years Primary health care	I = education and free safety devices, socket covers and cupboard catches and instructions on use C = free safety devices, socket covers and cupboard catches and instructions on use	Randomised controlled trial I = 101 C = 104	Observed behaviour	Significant increase in the use of outlet covers in both groups but not cupboard catches which took more effort to install
Kelly et al (1987)[107] USA	0-1 (well child attendances) Primary health care	I = 15 minute individualised counselling in child saftey at 3 well child visits in addition to routine care C = routine care (including safety education)	Randomised controlled trial I = 85 C = 86	Reported accidents, observed and reported behaviour knowledge	No change in accidents reported. Improvement in certain safety practices and some improvement in knowledge in intervention group.
Olds et al (1994)[63] USA	Pre-school children of teenaged or unmarried or poor women	Nurse home visitations during pregnancy & first two years of life: Four groups (1) when children aged 1-2 screened for sensory & developmental problems & referred (2) free transport provided pre natal & well child care at local clinics + screening in (1) (3) In addition to (1) & (2) families provided with nurse home visitor - average 9 visits (4) In addition to (1),(2) &(3) Nurse continued to visit until child was 2	Randomised controlled trial C1 ÷ ® =129 C2 _(combined for analysis) I3 = 73 I4 = 80 Numbers used in analysis relating to boil hazards)	Observed hazards Reported behaviour	At 34 months and 46 months in home assessment, homes of nurse visited families (groups 3&4) had fewer hazards than homes where there had been no nurse visits. No programme influences on extent to which mothers reported poisonous substances were kept out of reach of children. Or that children rode in cars with safety restraints

1989 law in Britain making it compulsory for children under 14 to be restrained when in the rear of a car provided a restraint was available has been high[56] There has been no published study reporting the effect on casualty rates.
Promotion campaigns include educational components and either discount or loan schemes for infant seats. Parental pre-natal child safety information and education at well baby clinics resulted in higher usage of restraints than in controls.[57,58] The US 'Bucklebear' programme used in daycare centres and nursery schools was successful in increasing children's use of safety seats or seat belts.[59] Free loan of restraints has also been shown to be effective[60,61] although the effect may reduce over time.[60]

D. The home environment

D.1 General home injuries

Social deprivation: General home injuries are more common in households with poor social circumstances. Rather than focusing on individual parenting behaviour it has been suggested that increasing financial and social support to deprived households with young children would have a beneficial effect on injury rates.[62] However, no relevant evaluation was identified. An RCT targeting poor, unmarried or teenage mothers of preschool children in the USA indicated that homes which had several visits from a nurse home visitor had fewer home hazards than those which had not been visited.[63]

Safe product design: Over a 20-year period there was a significant decline in associated injuries following the redesign of products associated with strangulation and suffocation.[64]

Safety devices: A variety of protective devices have been tested under experimental and field conditions and have been shown to reduce the risks of home injuries. These include smoke detectors and child resistant container closures. Others are also associated with reduced risk such as fireguards, stairgates, safety catches for cupboards, coiled kettle flexes, safety harnesses, safety film for interior glazing and thermostat control of tap water.[65] However, it is not clear what the efficacy of these are and high risk sections of the population are the least

likely to have access to most of these devices. See Table 6.

Parent and child education: Programmes aimed at raising awareness of home hazards and encouraging parents and children to reduce or avoid these risks have met with varying success. Home visits to people in poorer areas with specific advice on hazards, combined with health education and media campaigns resulted in around 50% more households making changes to the home environment.[66] In two RCTs a major increase in the use of electrical outlet covers was found when education was accompanied by free safety devices. However, use of cupboard catches, which are harder to apply, did not increase.[67,68]

D.2 Burns and scalds

Smoke detectors: There have been a series of evaluations of programmes designed to increase the use of smoke detectors. In one programme, smoke detectors were given away free and 81% were operational 8-12 months after the campaign.[69] One study showed a small reduction in fatalities due to fires in a community where smoke detectors were required by law in all homes. However, compliance was low.[70] See Table 7.

A programme comprising of a short education session provided by a paediatrician at well child clinics resulted in a significant increase in smoke detector installation compared to controls.[71]

Tap water temperature reduction: A RCT showed that provision of a free thermometer when combined with physician counselling was more effective than counselling by itself at reducing scalds.[72] Legislation in the US requiring new water heaters to be pre-set at safe temperatures was associated with a reduction in scald casualties and reduced domestic water temperatures over 10 years, however this study was not controlled and the result could reflect other changes in practice.[73]

A New Zealand RCT showed that where families relied on electric

Table 7 The home environment - prevention of burns and scalds

Author, date and country	Injury target group and setting	Aims and content of intervention	Study type and sample size	Outcome measures	Key results
Grant et al (1992)[109] USA	8-9 years School	Learn not to burn programme I = burn prevention programme through state schools. Materials produced by fire service. 22 key behaviours targeted. C = current method of burn prevention education	Randomised controlled trial (schools unit of randomisation) I = 20 school districts C = 10 school districts	Knowledge	No signficant differences between school districts. High baseline score.
Katcher et al (1989)[72] USA	All children - particularly under 3 years Primary health care	I = health care counselling and literature on safe domestic hot water temperature, free thermometer to check water temperatures and home visits to check temperatures in a sample of families (n = 27) C = pamphlet and discussion about tap water scald prevention and home visits to check temperatures in a sample of families (n = 13)	Randomised controlled trial I = 350 C = 347	Observed behaviour Reported behaviour Knowledge	12% of subjects reported lowering water temperatures but no significant difference between I and C. No differences between groups in terms of knowledge. 73% gained knowledge after the intervention.
McLoughlin et al (1985)[70] USA	General population Community-wide	I = evaluation of smoke detector legislation 5 years after its introduction C = no smoke detector legislation	Controlled trial I = 500 C = 400	(Deaths) Observed behaviour	Similar rates of detectors in both communities. Reductions in deaths greater in intervention community.
Miller et al (1982)[71] USA	All children (well child visits) Primary health care	I = paediatrician counselling at well child sessions to reduce burn injuries and wiating room pamphlet. Smoke detectors available at cost price C = usual care	Randomised controlled trial I = 120 C = 120	Observed behaviour	Significant increase in detectors installed in intervention house-holds - 25/55 installed detectors - no control group changes
Thomas et al (1984)[108] USA	Pre-school (well baby clinic) Primary health care	I = burns and scalds targeted, education session and discount coupons for smoke detectors at well child sessions C = standard health and safety information	Randomised controlled trial I = 29 C = 26	Observed behaviour	65% of intervention group had safe hot water temperatures at follow up visit. None of control group had safe temperatures. No difference in operational smoke detectors across groups.
Waller et al (1993)[74] New Zealand	Pre-school targeted at children under 3 Community-wide	"Hot water burns like Fire" programme. I = national mass media campaign and local pilot projects including community lobbying for building code legislation for safe water temperatures. Home education and water temperature measured by health staff in a random sample of homes C = National mass media campaign and measuring of water temperature	Randomised controlled trial I = 54 C = 56	Observed behaviour Attitudes and knowledge	There was a significant decrease in hot water temperatures in both groups after the campaigns, nevertheless temperatures remained unsafe in the majority of households.

Table 8 The home environment - prevention of poisoning

Author, date and country	Injury target group and setting	Aims and content of intervention	Study type and sample size	Outcome measures	Key results
Krug et al (1994)[78] South Africa	Under 5 years Primary health care	I = free distribution by health workers of child resistant containers for paraffin storage to parents and awareness raising C = awareness training only	Controlled trial 20,000 CRCs distributed.	Hospital clinic data for mortality and morbidity Observed and reported behaviour Attitudes, knowledge	Distribution of CRCs in study area reduced incidence of paraffin ingestion by 47% (no change in control area).
Sibert et al (1977)[77] UK	Under 5 years Community-wide	Children's aspirin and paracetamol preparations to be sold in in either child resistant containers or dark tinted packaging after January 1976	Before and after study without control	Hospital admissions	Significant fall in admissions for accidental salicylate posining between 1975 and 1976 (from 129 to 48)
Sibert et al (1985)[79] UK	Under 5 years Community-wide	Voluntary agreement by pharmaceutical industry 1981 - packaging of solid dose medications in CRCs or blister packs	Before and after study without control	Hospital admissions	No significant fall in hospital admissions over 5 year study period. Steady increase in poisoning with liquid preparations.
Walton (1982)[75] USA	Under 5 years Community-wide	Poison Prevention Packaging Act 1970	Before and after study without control	Hospital admissions death rates	Ingestion rates declined from 5.7/1000 in 1973 to 3.4/1000 in 1978 and the death rate declined from 2.0/100,0000 to 0.5/100,0000
Woolf et al (1987)[80] USA	Under 5 years Primary health care	I = emergency room counselling by medical staff on poison management (supplied ipecac and instruction on how to use it) C1 = pre and post-test questionnaire only C2 = post-test questionnaire only	Randomised controlled trial I = 119 families C1 = 83 C2 = 60 (59% completed F/U)	Knowledge Reported behaviour	Storage of ipecac increased from 37% - 68% in I From 29% -47% in C1 36% in C2 at F/U. Sig. difference in intervention group.
Woolf (1992)[81] USA	Under 5 years (families without ipecac) Home	I = mailed package intervention by poison centre staff for families seeking advice after poisoning incidents. Cabinet lock provided C = no intervention	Randomised controlled trial I= 169 150 F/U C= 167 151 F/U	Self report of injury Reported behaviour	Intervention group more likely to report presence of telephone sticker and use of storage lock. No differences in availability of ipecac & other reported poison behaviour. No difference in poisoning recurrence but short F/U period. Money off coupons did not work.

water heating, a national mass media campaign combined with local implementation projects could result in a reduction in hot water temperatures. However, where more than one form of water heating system was used temperature regulation/reduction was less likely to take place than if the heating was by electricity alone.[74] This reinforces the message that health education interventions can only be effective if the technology is there to support appropriate change.

D.3 Poisoning and suspected poisoning

Safe packaging of drugs and products: Because of the more deterministic relationship between types of packaging and accidental poisoning, and the large changes reported in some studies, uncontrolled before after studies are included in this section.

Uncontrolled studies from the US reported the effectiveness of child resistant packaging for drugs.[75-78] A controlled trial of children resistant containers for paraffin showed a 47% drop in paraffin ingestion compared to no change in the control area. However, the voluntary agreement by the pharmaceutical industry to package solid dose medications in child resistance containers or blister packs was not accompanied by a fall in hospital admissions in the UK and there was an increase in poisoning with liquid preparations over the 5 years from 1981-85.[79]

Managing poisoning incidents: A RCT of poison management demonstrated that parents provided with the emetic Ipecac were uncertain how to use it.[80] In another US RCT, families receiving a mailed poison education pack reported safer storage of hazardous substances.[81] See Table 8.

E. Play and sport injuries

Over 1 million children are injured each year outside of their homes, in parks, playgrounds, and using sports facilities.[82] A recent review of the costs and benefits of exercise highlighted the large number of injuries to young people playing sport and suggested that these cost the NHS more than any associated health benefits which, because they are not carried

Table 9 Community-wide studies

Author, date and country	Injury target group and setting	Aims and content of intervention	Study type and sample size	Outcome measures	Key results
Guyer et al (1989)[90] USA	Under 5 Community-wide	Health promotion campaigns based on 5 interventions: prevention of burns, poisonings, falls, suffocations and passenger RTSs	Controlled trial I = 9 communities 139,810 C = 5 communities 146,866	Accident and Emergency attendance Reported behaviour Knowledge	Reduction in motor vehicle occupant injuries but not in other injury areas 42% of households in I communities exposed to at least one intervention
Ozanne-Smith et al (1994)[92] Australia	All ages Community-wide	*Shire of Bulla 'Safe Living' Programme* All age, all injury type community programme based on Falkoping model. 113 strategy activities including traffic safety programmes for schools (Tziotis 1994) auidt of school playgrounds, professional training, bicycle helmet promotion. C = traffic education programme	Controlled trial I - Shire of bulla, pop 28,347 C - Shire of Melton, pop 28,812 (1986 figures)	Mortality and morbidity data. Observed behaviour Attidues Knowledge Area wide Environmental changes	Evidence of achievement of 4 objectives of programme 1) Increased community awareness 2) Development of injury prevention strategies (113 programmes developed) 3) hazard reduction (>50% recommendation of schools playground safety audit enacted) 4) Increased use of safety devices and equipment (helmets, safety seats, smoke detectors). Little evidence of reduction of injury morbidity. Some evidence from telephone survey of reduction in minor injuries.
Schelp[85] (1987) Sweden	General population Community-wide	I= Health promotion based on local community diagnosis Home and work environment targeted Range of interventions C = no intervention	Controlled trial I = Falköping 32,138 C = Linköping 34,750	Accident and Emergency attendance, admissions, deaths	Reduction of 27% in home accidents and 28% in occupational accidents
Schwarz et al (1993)[91] USA	General population Focus on urban African-American Community-wide	*'Safe Block Project'* Intervention by community workers involving home inspections and educational programme. Package of home safety devices supplied Emphasis on falls, fires, scalds, poisonings & violence prevention. C = no intervention	Controlled trial I = 3004 C = 1472	Observation of hazards Knowledge	Block representatives recruited for 88% of blocks. Intervention homes sig. more likely to have ipecac & smoke detectors No consistent differences for home hazards requiring major efforts. Distinct difference between intervention & control homes in safety knowledge.

forward to later life, are quite small.[83] No good quality studies were identified which evaluated the effectiveness of injury prevention interventions associated with sports. Similarly there has been little evaluation of playground layout, equipment and surfacing in terms of achieving injury reduction; no evaluated studies of training schemes for adults or children were identified.

A recent review suggests that a number of safety measures such as rule changes and use of safety equipment may be effective at reducing injuries as a result of organised sports in the 15–24 year age group. [7]

F. Community-based interventions

Community interventions may be distinguished by their shift away from the focus on individual responsibility and towards multi-faceted community wide interventions which ensure that everyone in a community is aware or involved. Popay and Young have reviewed community wide injury interventions.[10] They identified two dominant approaches: the health planning approach which emphasises behaviour change and safety education and the community participation approach which emphasises changing the physical environment where local people shape the intervention.

Within the last decade, Australia has developed considerable experience in community-based injury prevention,[84] based upon the Swedish 'Falkoping' model.[85]

Most of the evaluations of these community-based programmes use a simple before - after' design with no control group and are not considered further. The remainder use non randomised controlled trials comparing an area which received the intervention with one that did not. However, in several cases the control area was insufficiently comparable with the study area, so introducing the possibility of significant bias.[86-89] Only one evaluation used several intervention and control communities.[90] See Table *9*.

The Falköping programme, Sweden:[85] The programme included establishment of an

extensive network of people interested in injury prevention, education of policy makers and health workers, raising of public awareness, and provision of a local shop selling child safety products. The intervention area experienced a reduction of 27% in home accidents and 28% in occupational accidents.

The 'Statewide Child Injury Prevention Program (SCIPP)', USA:[90] Nine intervention communities and five control communities were selected in Massachusetts. Interventions targeted burns, poisoning, falls, suffocations and passenger traffic accidents. Households in the intervention communities had greater safety knowledge and higher behaviour scores than controls. There was a significant reduction of motor vehicle passenger injuries in the intervention communities. No evidence was found for the reduction of other target injuries.

'Safe Block Project', Philadelphia, US:[91] The programme targeted a poor inner city African American community, using community workers and recruiting black representatives from the local community. This method of 'cascade training' was successful in getting households involved. The intervention included an educational programme, home visits and the provision of safety equipment. The intervention was partially effective for those home hazards requiring minimal or moderate effort to correct. No information was provided on baseline comparability of the areas and no data were collected on accident rates.

The Shire of Bulla 'Safe Living' program, Australia:[92] In the initial three years of the project, 113 activities were developed, including training of professionals, environmental modification, audit and advocacy. There were increased sales of children's safety seats and restraints, smoke detectors, usage of the Early Childhood Injury Prevention Programme, wearing of helmets, training in child safety and improvements to playground safety. The only changes in outcome were a reduction in motor cycle injury and a reduction in self-reported injury.

G. Advice for commissioners and providers of services and research

More detailed guidance to purchasers on ways to reduce childhood injuries has been produced by the Child Accident Prevention Trust which can be read in conjunction with this bulletin.[93]

G.1 There is some evidence that unintentional injury can be prevented by legislation, environmental modification and occasionally by educational programmes or a combination of these measures.

G. 2 Purchasers could also ensure the increased availability of child car restraints through loan schemes, smoke detectors and bicycle helmets through educational campaigns and discount schemes, and the encouragement of parent education about home hazard reduction.

G.3 When using educational methods the target group needs to be involved in the planning process; participative rather than didactic approaches appear to have more success. One or two specific messages are preferable to a large number and endorsement by an 'expert' can be beneficial.

G.4 In order to implement legislation, educational campaigns are needed to influence public opinion and policy makers.

G.5 Community-based programmes should be based upon data derived from surveillance systems, they should target specific injuries and age groups and use these data systems to monitor the impact of the programme.

G.6 In order to deal successfully with unintentional injury, deprived populations at high risk should be encouraged to become involved in injury prevention programmes and be targeted for social programmes to reduce deprivation.

G.7 The review by Coleman et al[7] which focused on the 15-24 years age range found that the most effective measures were legistative or regulatory controls, which in road, sports and workplace settings were associated with fewer accidental injuries.

G.8 Purchasers in particular, need to help provide the framework and support for injury prevention initiatives in their area. This includes developing a long term strategy and effective focused leadership, support for collaboration between agencies, making available and widely disseminating local injury data, and the development of an advocacy role (eg. for area wide urban safety measures, improved product design, and legislation).

Inter-agency collaboration is important but it takes time to develop the networks and a range of local programmes.

Implications for research

G.9 There is a need for evaluation studies in relatively neglected areas of research such as targeting young adolescents, professionals and policy makers, the prevention of sports and leisure injuries and the broad context of social, transport and land use policies in relation to child and adolescent injury.

G.10 The quality of research also needs to be improved with more emphasis on well designed and evaluated programmes, using randomised controlled designs where possible along with qualitative methods to explore the effects on behaviour. It is essential to develop good quality measures of non fatal injury which include severity coding for use as outcome measures.

G.11 Research would also be useful which examined ways to promote collaborative multi-agency working and which provided sufficient operational detail on successful initiatives.

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6. Cholesterol: screening and treatment
7. Brief interventions and alcohol use
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