

Community-based childhood injury prevention interventions: what works?

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SUMMARY

Unintentional injury, with its broad range of injury types, possible countermeasures, and great number of agencies involved in its prevention, lends itself to community-based approaches. In this paper we examine 10 community-based injury prevention programmes that have targeted childhood injury prevention and have been evaluated using some measure of outcome. We investigate the nature of the intervention, targeting, the length of programmes and multi-agency involvement. We also consider how the programmes have been evaluated, and what outcome, impact and process measures have been used. The information on the intervention and how it was evaluated, how effective the

programme was, and the strength of the evidence, is summarized in tabular form. There is increasing evidence emerging about the effectiveness of community-based approaches in injury prevention. Important elements of such approaches are long-term strategy, effective focused leadership, multi-agency collaboration, tailoring to the needs of the local community, the use of local injury surveillance, and time to coordinate existing and develop new local networks. We recommend that there is a need to develop indicators to assess and monitor a culture of safety, programme sustainability and long-term community involvement.

Key words: children; community-based programmes; systematic reviews; unintentional injury prevention

INTRODUCTION

In recent years, health promotion has attempted to address the complexity of many health problems by employing community-based approaches (Tones and Tilford, 1994). These represent a shift in emphasis from an individual to a social responsibility for health (Finney *et al.*, 1993) and stress the importance of multiple interventions, which can complement and reinforce each other in particular geographical areas. Also embodied within such approaches is a commitment to addressing health inequalities and the need to give people more power over their lives. Community-based approaches have been used and evaluated in a number of health promotion fields, including the prevention of cardiovascular disease (Puska *et al.*, 1989). Unintentional injury, with its broad range of injury types, possible countermeasures

and the large number of agencies involved in its prevention, lends itself to community-based approaches.

In this paper we examine community-based injury prevention programmes that, either wholly or in part, have targeted childhood injury prevention, and have been evaluated using some measures of outcome. We consider whether such approaches have been effective and which components work. We also discuss the implications for the development of interventions in the future and how these can be evaluated.

Unintentional injury

Unintentional injury represents a significant public health problem in all higher income

countries and an increasing number of lower income countries (Manciaux and Romer, 1991) but has, until recently, been neglected on both the national and international agenda [World Health Organization (WHO, 1996)]. Once overshadowed by other causes of death and ill health, injuries have grown in relative importance as many diseases have been controlled. In England, unintentional injury is the main cause of death in children and young people, is a major cause of ill health and disability, is responsible for considerable financial and psychological costs and is strongly linked with social deprivation. Its importance as a major public health problem has been recognized by its inclusion as a target in 'Saving Lives: Our Healthier Nation', England's Public Health Strategy document (Secretary of State for Health, 1999).

There is a wide range of possible counter-measures available for unintentional injury, but relatively few measures have been implemented at a community-wide level. There has been a longstanding debate within the injury field about the relative importance of 'passive' environmental or engineering solutions (e.g. traffic calming, product design, playground modification) versus 'active' behavioural solutions (e.g. pedestrian skills training, promotion of cycle helmet wearing). The community-based approach to injury prevention offers the opportunity to stimulate 'a process of cultural change which allows an optimal mix of environmental and behavioural solutions to be put into place' (Moller, 1992). Changes in behaviour may occur at the whole community level through networking, mutual support and beyond this to cooperative advocacy for local policy changes. A coordinated approach by a range of agencies is an essential ingredient: thus, injury prevention is less divided by sectoral allegiances and a common culture of safety allows the adoption of complementary solutions, which should enable a multiplier effect to be achieved (Moller, 1992).

The philosophy behind community development set out in the Ottawa Charter for Health Promotion incorporated a concern with reducing inequalities and promoting ownership of health-related issues (WHO, 1986). This broad concept of safety promotion was developed in relation to injury prevention in the mid 1970s by workers at the Karolinska Institute in Sweden. The Manifesto for Safe Communities was set out at the First World Conference on Accident and Injury Prevention held in Sweden in 1989

(WHO, 1989). Since that time, an increasing number of communities around the world have used community-based approaches in injury prevention and some of these programmes have been evaluated. Lessons learnt from such programmes would have direct application in how best to develop, coordinate and evaluate injury prevention programmes at a local level. Very few community-based prevention programmes have been evaluated until recently.

METHODS

This paper uses as its source a systematic review of the literature, which seeks to answer the question 'how effective are health promotion interventions in preventing unintentional injuries in childhood and young adolescents?' (Towner *et al.*, 2001). This source review has built on and revised three earlier reviews published in 1993 (Towner *et al.*, 1993) and 1996 (Nuffield Institute for Health and NHS Centre for Reviews and Dissemination, 1996; Towner *et al.*, 1996). It includes 155 studies or groups of studies published between 1993 and 1996. Of these 155 studies, 10 were included that evaluated community-based injury prevention programmes. We are particularly interested in those programmes that targeted childhood injury.

In the source systematic review, the relevant literature was identified by a variety of means. Computerized databases including MEDLINE, BIDS (and more recently the Web of Science) and Excerpta Medica, and more specialized sources such as the Transport and Road Laboratory (TRL) database were searched (a full list of databases searched and search terms used is available on request). This electronic search was supplemented by hand searching a number of key journals such as *Accident Analysis and Prevention* and *Injury Prevention*, along with the reference lists of relevant published articles and books. In addition, key informants (researchers and specialists in the area of child injury prevention) were consulted. The criteria for the inclusion of studies were as follows.

- (i) They were written in English and published between 1975 and 2000 (the last search was carried out in June 2000).
- (ii) They related to the prevention of unintentional injuries (solely or in part).

- (iii) The target population included children <15 years old and results were reported for this group.
- (iv) They described either a primary intervention measure to prevent accidents occurring or a secondary measure to prevent or reduce the severity of injuries.
- (v) They had been evaluated using some measure of outcome or impact. These included changes in injury mortality or morbidity, changes in observed or reported behaviour, environmental change or hazard removal, or changes in knowledge or attitudes.

Violence prevention studies were excluded, except in those cases where they were combined with unintentional injury studies.

All studies were read and reviewed independently by two reviewers. Where statistical advice or other specialized knowledge was required a third reviewer was consulted. A standardized data extraction form was devised and used to record details from each study included (available on request). Details recorded included the date and place of the study, the injury target group, and the aim, content and setting of the intervention. Where interventions had been targeted at socially or economically disadvantaged groups this was noted. In addition, details about the evaluation were recorded. This included a brief description of the methods used (the study design, sample size, data collection methods, outcome, impact and process measures). In particular, we were keen to assess how the intervention and control groups were selected and how comparable these groups were. A note was also made of strengths and weaknesses of the evaluation. The British National Health Service's Centre for Reviews and Dissemination guidelines on carrying out systematic literature reviews (Arblaster *et al.*, 1995) were consulted for information regarding the process of assessing the quality of the evidence of the various studies. The reviewers reached a consensus decision on the quality of the evidence. Each study was graded on a five-point scale ranging from weak to good (i.e. weak, reasonable/weak, reasonable, reasonable/good, good). Key results were recorded and a consensus decision was made about the effectiveness of the intervention. Details from the data extraction forms were used to devise summary tables for each study included. At this stage, those studies where the evidence was rated as weak were excluded.

A total of 15 evaluated studies were identified that related to community-based studies. Five of the programmes used a simple before–after design, with no control group, and three of these provided very few details of the intervention or evaluation. We thus excluded five studies from the paper (Tellnes, 1985; Robertson, 1986; Sahlin and Lereim, 1990; Jeffs *et al.*, 1993; Lindquist *et al.*, 1998). This paper examines the remaining 10 programmes in more detail.

In the Results, we describe the 10 programmes identified: the features of the intervention, the groups or communities they target, the outcome, and process measures used in the evaluation. We then discuss injury surveillance systems, examine how intervention and control communities have been chosen, and examine which process measures have been employed.

RESULTS

Intervention

The 10 programmes are summarized in Table 1: (Schelp, 1987; Svanström *et al.*, 1996) (1); (Guyer *et al.*, 1989) (2); (Schwarz *et al.*, 1993) (3); (Davidson *et al.*, 1994; Kuhn *et al.*, 1994) (4); (Hennessey *et al.*, 1994; Ozanne-Smith *et al.*, 1994) (5); (Ytterstad, 1995; Ytterstad and Sogaard, 1995; Ytterstad and Wasmuth, 1995; Ytterstad *et al.*, 1998) (6); (Svanström *et al.*, 1995) (7); (Day *et al.*, 1997) (8); (Petridou *et al.*, 1997) (9); and (Coggan *et al.*, 1998; Coggan *et al.*, 2000) (10).

Six out of the 10 programmes are based on the WHO Safe Communities Model, initially developed in the community of Falköping in Sweden (study 1). This model combines two elements: community diagnosis, which relies on a local surveillance system to provide an accurate picture of the local injury problem, and a reference group to coordinate activities. The six programmes took place in Scandinavia, Australia and New Zealand (Table 1: studies 1, 5, 6, 7, 8 and 10). Of the remaining projects, three were conducted in the United States (2, 3 and 4) and one in Greece (9).

Targeting

Five of the six programmes based on the Safe Communities Model have targeted a range of ages (except study 6). The Shire of Bulla Safe Living Program (study 5), for example, targeted all

Table 1: Community-based injury prevention programmes

Author, date and country	Injury target group and setting	Aims and content of intervention	Study type and sample size	Outcome impact and process measures	Key results
1a. (Schelp, 1987) 1b. (Svanström <i>et al.</i> , 1996) Sweden	Home and occupational injuries targeted Children and older people	Falköping Accident Prevention Programme Based on community diagnosis and use of reference group to coordinate activities Education of policy makers and health workers Range of interventions	Controlled trial (a) I = Falköping C = Lidköping (b) I = Falköping (pop. 32 022) C ₁ = Skaraborg County (pop. 277 397) C ₂ = Sweden (pop. 8 644 125)	(i) Deaths (ii) Hospital admissions (iii) Accident and Emergency attendance (a) 1979–1982 (b) 1983–1991	(a) Reduction of 27% in home accidents and 28% in occupational accidents <i>Effective</i> (b) Hospital admissions increased by 8.7% (females) and 4.9% (males) in I. Smaller increases in C ₁ and C ₂ <i>Ineffective therefore inconclusive overall</i> Reasonable/weak evidence (i) Reduction in passenger motor vehicle injuries in I compared with C No evidence found in the reduction of other target injuries (ii) Exposure to prevention messages associated with safety behaviour in I exposed to one or more interventions <i>Partially effective</i> Good evidence
2. (Guyer <i>et al.</i> , 1989) USA	Children under 5 years	Statewide Child Injury Prevention Program (SCIPP) Health promotion campaigns related to burns, poisoning, falls, suffocations and passenger motor vehicle injuries	Controlled trial I = nine communities (pop. 139 810) C = five communities (pop. 146 866)	(i) Accident and Emergency attendance (ii) Reported behaviour (iii) Knowledge	(i) Reduction in passenger motor vehicle injuries in I compared with C No evidence found in the reduction of other target injuries (ii) Exposure to prevention messages associated with safety behaviour in I exposed to one or more interventions <i>Partially effective</i> Good evidence
3. (Schwarz <i>et al.</i> , 1993) USA	General population Focus on urban African-American population	Safe Block Project In poor inner city community Community workers and community representatives involved in home inspections and educational programme Focus on falls, fires, scald burns, poisonings and violence	Controlled trial I = census tracts in Philadelphia, 3004 homes C = census tracts in Philadelphia, 1060 homes	(i) Observation of hazards (ii) Knowledge (iii) Community involvement	(i) Intervention homes significantly more likely to have Ipecac and smoke detectors (minimal-moderate effort), but fewer differences for home hazards requiring major effort (ii) Distinct difference between I and C houses in safety knowledge (iii) Community representatives recruited for 88% of blocks <i>Partially effective</i> Good/reasonable evidence
4a. (Davidson <i>et al.</i> , 1994) 4b. (Kuhn <i>et al.</i> , 1994) USA	Children aged 5–16 years Disadvantaged community	Safe Kids/Healthy Neighborhoods Injury Prevention Program Coalition of organizations in children and reduction of assaults to children Involved playground renovation, safety equipment, supervised activities and education (26 organizations)	Controlled trial I = Central Harlem Pop. of children <17 years = 28 457 C = Washington Heights Pop. of children <17 years = 66 305	(i) Deaths (ii) Hospital admissions (iii) Participation in study	(i) Significant reductions in injuries in I and C areas In I, 44% reduction in targeted injuries In I, decline specific to targeted injuries (iii) 10 000 children participated in specific programmes <i>Partially effective/inconclusive</i> Reasonable evidence

Table 1: continued

Author, date and country	Injury target group and setting	Aims and content of intervention	Study type and sample size	Outcome impact and process measures	Key results
5a. (Ozanne-Smith <i>et al.</i> , 1994) 5b. (Hennessey <i>et al.</i> , 1994) Australia	All ages All injury types	Shire of Bulla Safe Living Program Based on Falköping model and injury surveillance Aimed to prevent injuries, reduce hazards and increase public awareness 113 preventive programmes, with emphasis on training professionals, environmental modification, audit and advocacy	Controlled trial I = Shire of Bulla (pop. 28 347) C = Shire of Melton (pop. 28 812)	(i) Mortality and morbidity data (ii) Observed behaviour (iii) Area-wide environmental change (iv) Attitudes knowledge	(i) Little evidence of reduction of injury morbidity Some evidence for telephone survey of reduction in minor injuries (ii) Increased use of safety devices and equipment—helmets, safety seats, smoke detectors (iii) Hazard reduction (>50% of recommendations following playground safety audit enacted) (iv) Increased community awareness <i>Partially effective</i> Good evidence
6a. (Ytterstad and Wasmuth, 1995) 6b. (Ytterstad, 1995) 6c. (Ytterstad and Sogaard, 1995) 6d. (Ytterstad <i>et al.</i> , 1998) Norway	General population but specific components targeted at children Targeted at children 0–4 years of age	Harstad WHO Safe Community Programme All ages, all injury types programme over a period of 7–9 years (a, b) Targets included child pedestrians and cyclists—infant car loan schemes, lobbying for cycle paths (c) Burn prevention—counselling, professional awareness raising, safety devices (d) Burn prevention—cooker guards and lowering tap water thermostats Educational activities Programme focused on its own sustainability	(a) Controlled trial I = Harstad (pop. 22 000) C = Trondheim (pop. 134 000) (b) Before and after study I = Harstad (pop. 22 000) C = Trondheim (pop. 134 000) (c) Controlled trial I = Harstad (pop. 22 000) C ₁ = Trondheim (pop. 134 000) C ₂ = six towns around Harstad (pop. 14 000) (d) Controlled trial I ₁ = Harstad (pop. 23 000) I ₂ = six towns around Harstad (pop. 14 000) C = Trondheim (pop. 134 000)	(a) Mortality data Hospital admissions A and E attendance Primary care (b) Hospital admissions A and E attendance (c) Mortality data Hospital admissions A and E attendance (d) Morbidity data Outpatient admissions records	(a) 27% reduction in overall traffic injury rate Significant reduction for 0–9 years and 15–24 years <i>Partially effective/inconclusive</i> (b) 0–15 years—37% reduction in cyclist injuries and 54% reduction in pedestrian injuries—decreased exposure <i>Partially effective/inconclusive</i> (c) 53% reduction in burn injury rates in I, 10% increase in C ₁ and 14% decrease in C ₂ Admissions in I in later period less severe <i>Effective</i> (d) Decrease in burn injury rates at 51.5% in I ₁ , 40.1% in I ₂ and increase of 18.1% in C <i>Inconclusive</i> Reasonable evidence

Table 1: continued

Author, date and country	Injury target group and setting	Aims and content of intervention	Study type and sample size	Outcome impact and process measures	Key results
7. (Svanström <i>et al.</i> , 1995) Sweden	Children 0–14 years	Lidköping Accident Prevention Programme Community-wide injury prevention programme (a) Surveillance of injuries (b) Provision of information (c) Training (d) Supervision (e) Environmental measures Specific activities—bicycle helmet campaigns, first aid training for parents, loan schemes, removal of local hazards	Controlled trial I ₁ = Lidköping (pop. 35 949) C ₁ = four surrounding municipalities (pop. 42 078) C ₂ = Skarabourgh county (pop. 278 162)	(i) Hospital discharge register data (ii) Process data: notes and reports of health planners	(i) From 1983 to 1991 a reported annual decrease in hospitalized injuries of 2.4% (boys) and 2.1% (girls) in I ₁ In C ₁ , increase in hospitalized injuries of 0.6% (boys) and 2.2% (girls) In C ₂ , decrease of 1.0% (boys) and 0.3% (girls) <i>Inconclusive</i> Reasonable/weak evidence
8. (Day <i>et al.</i> , 1997) Australia	General population	Latrobe Valley Better Health Project All ages, community-based approach to prevent injuries, reduce hazards and increase public awareness (a) Home (b) Sports (c) Playground injuries, and (d) Alcohol misuse among youth Exhibition, home safety training, education for new mothers Protective sports equipment promoted Playground safety—environmental measures Mass media and community event	Before and after study (non-targeted injuries used for comparison data) (a) Injury surveillance system (Victorian Injury Surveillance System) (b) Telephone survey 375 households pre-test, 400 households post-test	(i) Emergency Department presentations (ii) Self-reported injury Knowledge (iii) Playground hazards	(i) Overall decline in rate of attendance from 6594 to 4821/100 000 for targeted injuries, compared with a small decrease in non-targeted injuries Significant decrease in playground injuries among 5- to 14-year olds (ii) Telephone survey Estimated 908 injuries prevented Non-significant decrease in rate of self-reported injuries from 62.7 to 48.2/1000. Non-significant increase in injuries requiring medical attention from 24.5% to 31.9%. Modest increases in knowledge (iii) Evidence of hazard removal in playgrounds Process: 46 000 educational contacts with community on home injury prevention Evidence of institutionalization of programme <i>Partially effective/inconclusive</i> Reasonable/weak evidence

Table 1: continued

Author, date and country	Injury target group and setting	Aims and content of intervention	Study type and sample size	Outcome impact and process measures	Key results
9. (Petridou <i>et al.</i> , 1997) Greece	Young people 0–18 years Older adults ≥ 65 years	Greek Island Community Injury Prevention Project Multi-faceted intervention involving local community leaders and activities for parents, teachers and children Home visits, counselling on home hazards	Controlled trial I = Island of Naxos (172 households) C = Island of Spetses (177 households)	(i) Self-reported injuries (ii) Observed hazards Attitudes Knowledge	(i) No difference in accidents reported in I and C (ii) For I, improvements on 11 out of 28 hazard variables (iii) Improvements in 1/28 hazard variables (improvement related to changes that could easily or cheaply be implemented) <i>Partially effective</i> Reasonable/weak evidence
10a. (Coggan <i>et al.</i> , 1998) 10b. (Coggan <i>et al.</i> , 2000) New Zealand	General population with specific components targeted at children 0–14 years of age Multicultural urban community	Waitakere Community Injury Prevention Project (WCIPP) All ages, all injuries, prevention programme based on WHO model. Seven priority areas—Maori, Pacific, children, young people, older people, alcohol and roads. Three approaches (a) Promotion (b) Education and awareness (c) Advocacy and environmental change Range of activities including promotion of car restraints, cycle helmets, smoke alarms, burn and scald education	Controlled trial I = Waitakere (pop. 155 000) C ₁ = comparison community (pop. = 147 000) C ₂ = rest of Auckland	(i) Injury rates (hospital admissions and census data) in I, C ₁ and C ₂ (ii) Data from Land Transport Safety Authority and Fire Service (iii) Self-reported injury and (iv) Self-reported behaviour (telephone survey $n = 4000$ in I and C ₁) (v) Reach/awareness in total population and organizations	(i) No significant reductions in admissions overall in I, C ₁ and C ₂ In children 0–14 years, decrease in admissions in I, no decrease in C ₁ or C ₂ (sig) (ii) Land Transport data annual increase of 7% in adults appropriately restrained in front seats, 7% increase in children in I (C ₁ , not clear) (iii) No reduction in self-reported injury in I and C ₁ , but fewer injured people required medical treatment (iv) Significant increases in ownership of child restraints, pool fencing, stair gates and protective sports equipment in I compared with C ₁ (v) 85% of organizations in I aware of intervention compared with 25% in C ₁ <i>Partially effective</i> Good/reasonable evidence

Pop., population; I, intervention; C, control.

age groups and injuries occurring in home, school and leisure environments. The three US studies targeted children, and the Greek island study targeted young people and older adults. The Statewide Child Injury Prevention Program in Massachusetts (study 2) selected the main injury types affecting pre-school children, for which a proven countermeasure was available, and thus developed programmes aimed at the prevention of burns, poisoning, falls, suffocations and passenger road traffic accidents. Two programmes specifically targeted deprived communities: the Safe Block Project (study 3) in a poor African-American inner city community in Philadelphia, and the Safe Kids/Healthy Neighborhoods Program (study 4), in a mainly non-Hispanic, black community in Harlem. One programme was based in a multi-cultural urban community in New Zealand (study 10) and had specific community components for Maori and Pacific people.

Length of intervention

Some programmes had been in progress for many years. The Harstad programme (study 6) from Norway developed over a period of 7–9 years. The evaluation of the Shire of Bulla Safe Living Program and the Waitakere Community Injury Prevention Project (studies 5 and 10, respectively) related to the first 3 years of longer projects. In contrast, the Greek island (study 9) and the Safe Block Project (study 3) interventions were both of short duration.

Multi-agency approaches

A feature of most of the community-based programmes has been the involvement of a range of organizations drawn from health, Local Authority, voluntary and commercial agencies. Interventions have taken place in a variety of settings: home, school, roads and neighbourhoods. In the Falköping programme (study 1), for example, importance was placed on raising public awareness and local journalists were members of the multi-agency group. The owner of a local shop selling child safety products was also a key member of the group.

The involvement of local people and the development of local ownership were important features of several programmes, and the number of local people participating in local programmes was sometimes used as a process measure in the

evaluation. For example, the recruitment of representatives of neighbourhood housing blocks was regarded as a measure of community involvement in the Safe Block Project (study 3). The Waitakere Community Injury Prevention Project was placed within local government: this provided the council with an avenue to interact with the voluntary sectors of the community and ‘thereby contribute to the social structure of Waitakere’ (study 10). The Safe Communities Model advocates the need for a reference group to coordinate the activities of the agencies involved in delivering the intervention. The New Zealand project stressed the pivotal role of project coordinators.

Nature of the intervention

An innovative feature of many programmes was the attempt to deliver a range of diverse activities at the same time. Unlike some health problems, the range of possible preventive activities is vast, and no intervention alone is likely to result in observable differences in the injury mortality or morbidity experienced by a single community. The Safe Kids/Healthy Neighborhoods Program (study 4) aimed to reduce outdoor injuries in children. Specific interventions included the renovation of playgrounds, the involvement of children and adolescents in safe supervised activities, which taught them useful skills, the provision of injury and violence prevention education and the supply of safety equipment at a reasonable cost. Several of the programmes included elements that resulted in environmental change, or lobbied for environmental change. For example, lobbying for the provision of cycle paths was a feature of the Harstad programme (study 6), and a parent pressure group in the Latrobe Valley Project (study 8) was active in changing Council priorities with respect to the refurbishment of existing playgrounds and the creation of new ones. The scale of many programmes meant that educational, environmental and policy approaches were all feasible and these approaches were often combined. The New Zealand project aimed to cover all ages and all injury types, but in practice the focus was on child safety.

Evaluation

Of the evaluation designs employed in the 10 programmes summarized in Table 1, none have

used a randomized controlled design. Only one evaluation used several intervention and control communities (study 2), eight used one main control community, and one (study 8) measured success by a comparison of targeted and non-targeted injuries.

The Statewide Child Injury Prevention Programme in the USA (study 2) selected nine intervention and five control communities from 351 potential cities and towns in Massachusetts, matched for a number of relevant variables. In the Safe Living Program (study 5), a demographically matched Shire, the Shire of Melton, was selected as a control community. In the Greek island project, the islands of Naxos and Spetses were selected as intervention and control communities.

Two of the evaluation designs were considered 'good' (studies 2 and 5), two 'good/reasonable' (3 and 10), two 'reasonable' (4 and 6) and four 'reasonable/weak' (1, 7, 8 and 9).

Outcome measures

Local injury surveillance systems were not only used as a means of identifying local problems and targets for interventions, but also as a source of outcome data in programme evaluation. Such outcome data related primarily to Accident and Emergency attendance and hospital admissions. In the Harstad programme (study 6), length of hospital stay was used as a proxy measure of injury severity. In a few studies (5, 8, 9 and 10), sample population questionnaire surveys were used to elicit self or proxy reports of injuries as an outcome measure. Area-wide environmental changes were measured in the Shire of Bulla Program (study 5), numbers of home hazards in the Safe Block Project (3) and the Greek Island Programme (9), and sales of safety equipment in the Falköping study (1). Reported behaviour (e.g. use of safety equipment) and knowledge were used as measures of programme impact in several programmes.

Process measures

The Shire of Bulla Safe Living Program, the Latrobe Valley Better Health Project and the Waitakere Community Injury Prevention Project (studies 5, 8 and 10, respectively) provide more detailed documentation of the process of the intervention. Process measures included programme reach, community participation, media

reporting, key informant interviews with coordinators and with management group members, and detailed case studies of different project components.

Overall effectiveness

Eight of the studies were considered partially effective and two inconclusive (1 and 7).

DISCUSSION

In systematic reviews of effective injury prevention, most evaluated studies described relate to single countermeasures, such as the promotion of bicycle helmets or child safety seats (Towner *et al.*, 2001). Community-based studies such as those described in this paper, offer the opportunity to examine whether using a multi-agency coordinated approach provides the opportunity to change the whole culture of safety within a community and to assess the result in terms of health gain.

What is apparent from the results section of this paper is the great variety in the content of the intervention in the 10 programmes investigated. Only in a few cases is the full extent of the intervention documented, e.g. the Safe Living Program, where details of the 113 programme components have been described. One element common to nine of the 10 programmes (the exception is programme 10) is the importance of injury surveillance systems, not just in evaluating the impact of the programme, but in contributing to the intervention itself. Data collected in these systems can be utilized in generating local interest and mobilizing community involvement, attracting media and political interest, obtaining resources and for targeting specific local problems.

For injury surveillance systems to be useful for evaluation purposes (and to make comparisons between, or to summarize findings from similar studies) it is necessary to have meaningful and consistent outcome measures. Death as an outcome is too rare an event to provide information on what to target or to be used to evaluate local campaigns. Most of the programmes have used hospital admission or Accident and Emergency attendance as measures of non-fatal injury in a community. There are flaws in using such measures because they may reflect changes in the use of, and access to, health services rather than

true injury rates. For instance, in the Latrobe Valley Project (study 7), changes in the hospital resourcing mechanism led to large-scale variations in admission rates. One of the programmes attempted to utilize a proxy measure of injury severity, which in this case was hospital bed days.

Injury surveillance systems are potentially expensive to establish as part of community-based programmes. Several programmes relied on existing (usually health care) databases for local injury data. Under these circumstances, data collection considerations would be likely to have a direct effect on both the selection of outcomes and the selection of controls in programme evaluations. If existing health information systems are used, only a limited amount of information is collected and outcomes tend to relate to the uptake of health services. The existence of similar data collection systems in other areas may govern the selection of control communities. This may be a very arbitrary means of choosing controls and lead to the selection of control areas that appear to be very different from intervention communities.

Of the 10 programmes reviewed in this paper, only one has included multiple intervention and control communities: the Statewide Child Injury Prevention Program from the USA, which selected these communities from 351 potential sites in the state of Massachusetts. Its intervention, however, only took place over a 22 month period, far shorter than in many of the other programmes. In the other programmes only one control community was selected, sometimes with comparisons with national statistics or a broader area. In the Harstad Programme, the intervention community of Harstad with a population of 23 000 was compared with the city of Trondheim, a much larger city, 1000 km away. The Safe Kids/Healthy Neighborhoods Program in Harlem had one intervention and one control area, and although both were disadvantaged communities, the demographic characteristics of the two areas were different. Even when the intervention and control areas were of similar size and socio-demographic mix, as in the case of the Falköping programme (study 1), there was considerable under-reporting in the control area, which resulted in difficulties in interpreting the results.

Demonstrating the effectiveness of complex interventions is not straightforward. Community-based, multi-faceted interventions that target a range of injury types do not lend themselves to experimental evaluation approaches. The value

of randomized controlled trials for use in complex interventions has been questioned (Speller *et al.*, 1997) and there is considerable debate on this issue within health promotion. We agree with this argument, but feel that the strength of the evidence is enhanced by the selection of appropriate control communities or comparison groups. The provision of detail about the nature of the intervention also enhances the interpretation of results, as well as providing necessary information for implementation elsewhere.

Evaluating the effectiveness of health promotion activities in the field of childhood injury is constrained by the wide range of injury types and variety of possible interventions. As death and serious injury are relatively rare events, attributing health gain to a single health promotion intervention may not be appropriate. Under these circumstances, the collection of process data, such as information on programme reach, may improve our understanding of the impact of community-based approaches.

The range of process measures employed in the different studies was diverse. Detailed case studies used in the Waitakere study, for example, documented the importance of different models of programme delivery to be tailored to the needs of different cultural groups (study 10). The Maori component of the project was based in a Marae (Maori community grouping) and allowed distinctive Maori perspectives of 'a holistic view of health and well-being' to be incorporated into the programme. Other process measures included the degree of community involved, as reported in the 'Shire of Bulla Program' (study 5), media reporting (Falköping study), and indicators of a shift in the culture of safety within an organization (the local council requiring all projects and programmes to state how their project meets or furthers safety) as in the Waitakere study (study 10).

CONCLUSION

There is increasing evidence emerging regarding the effectiveness of community-based injury prevention programmes. The use of multiple interventions implemented over a period of time can allow injury prevention messages to be repeated in different forms and contexts and can begin to develop a culture of safety within a community. Important elements of community-based programmes are a long-term strategy,

effective and focused leadership, multi-agency collaboration, the use of local surveillance to develop locally appropriate interventions and tailoring interventions to the needs of the community. Time is also needed to coordinate existing networks, and to develop new ones. However, a positive and sustained impact of community-based programmes on injury rates has not yet been demonstrated conclusively. There is a need to develop valid and reliable indicators of impact and outcome appropriate to community studies. Where proxy measures are used for injury outcomes, it is important that there is clear evidence of the association between the proxy (e.g. hazard removal, knowledge gain or behaviour change) and injury risk (Towner *et al.*, 1996). There is also an urgent need to develop and monitor indicators to assess and monitor a culture of safety, programme sustainability and long-term community involvement. Community-based injury prevention programmes have been hampered by the lack of resources allocated to both their programme development, and appropriate and rigorous evaluation.

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