

Community-Based Injury Prevention Interventions

Terry P. Klassen, J. Morag MacKay, David Moher, Annie Walker, Alison L. Jones

Abstract

Community-based interventions offer a promising solution for reducing child and adolescent unintentional injuries. By focusing on altering behavior, promoting environmental change within the community, or passing and enforcing legislation, these interventions seek to change social norms about acceptable safety behaviors. This article systematically reviews 32 studies that evaluated the impact of community-based injury prevention efforts on childhood injuries, safety behaviors, and the adoption of safety devices. Interventions targeted schools, municipalities, and cities. Most relied on an educational approach, sometimes in combination with legislation or subsidies, to reduce the cost of safety devices such as bicycle helmets.

Results indicate that community-based approaches are effective at increasing some safety practices, such as bicycle helmet use and car seat use among children. The evidence is less compelling that such interventions increase child pedestrian safety, increase adolescent vehicle safety by reducing drinking and driving behaviors, or reduce rates of several categories of childhood injuries. Strong evidence supporting the effectiveness of community-based interventions is lacking, in part because few studies used randomized controlled designs or examined injury rates among children and youths as outcome measures. Nonetheless, this review identifies common elements of successful community-based approaches that should be replicated in future studies.

First, the use of multiple strategies grounded in a theory of behavior change is critical. Second, to maximize success, interventions should be integrated into the community and approaches should be tailored to meet unique community needs. Third, community stakeholders should be included in the development of community-based strategies. This community involvement and ownership of the intervention increases the likelihood of modeling and peer pressure, leading to widespread adoption of a safety behavior. Finally, when possible, a randomized controlled design should be used to maximize the trustworthiness of reported findings and aid decisions about where to invest resources in community-based approaches to injury prevention.

Community-based interventions offer one approach to reducing injuries by changing community norms and behaviors and by altering the physical environment of communities to reduce the risk of injury. The community-based approach may have particular relevance for

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children, as interventions often target the safety awareness, attitudes, and behaviors of the child and the parents. Gradually, as families engage in safety behaviors or use safety devices more frequently, new norms reflecting the goals of the intervention emerge within a community. The process is similar for youths; however, peer pressure also plays a considerable role in promoting or inhibiting the adoption of safety behaviors within this population. Acceptance of new behaviors by the peer group may be crucial to a program's success.

Although community-based interventions hold promise, there is a paucity of evidence examining the impact of these approaches on safety behaviors or injury rates among children. This article defines community-based interventions and systematically reviews relevant literature to ascertain the effectiveness of such approaches in reducing childhood unintentional injuries (see the article by DiGuseppi and Roberts in this journal issue for a description of a systematic review). The key characteristics of successful community-based programs are identified by comparing elements of programs that improved safety behaviors or reduced injury rates with elements of programs that failed to impact these outcomes.

Defining Community-Based Interventions

In this article, community-based interventions are those that target a group of individuals or a geographic community but are not aimed at a single individual. This definition includes cities, municipalities, and schools. It excludes interventions delivered in clinical settings and interventions targeting areas as large as states or countries, since injury prevention strategies focused at these levels are covered elsewhere in this journal issue (see the articles by DiGuseppi and Roberts, and by Schieber, Gilchrist, and Sleet.)

Community-based interventions employ a broad array of strategies that include education/behavior change, engineering/technology, and legislation/enforcement. Educational strategies increase awareness of injury risk or the importance of risk-reducing behaviors, and they may include media broadcasts, public service announcements, classroom instruction, or written material. Behavioral strategies have the same goal and may involve incentives, negative feedback, and modeling. Alternatively, the goal of engineering/technology interventions is to alter the physical environment (such as placing speed bumps on neighborhood streets or installing smoke detectors in homes) or modify the design of safety devices (such as bicycle helmets or child passenger

restraints). Finally, legislation/enforcement interventions involve the passage and enforcement of new laws or the increased enforcement of existing laws.

Evaluating Community-Based Injury Prevention Strategies

Studies were included in this review if they met the following criteria: (1) the study included a control group that did not receive the intervention, (2) the target population was between 0 and 19 years of age, (3) the study examined the effectiveness of a community-based intervention, and (4) the study reported injury rates or change in an injury-reducing behavior. (See the Appendix at the end of this article for details about the search strategy, methods, and analysis used in this systematic review.)

Although randomized controlled trials (RCTs) are the study design most likely to provide unbiased estimates of the impact of interventions (see the article by DiGuseppi and Roberts in this journal issue), the review also included nonrandomized comparison group studies for two reasons. First, a previous review of community-focused interventions found that most such studies did not use a randomized design to evaluate program impact.¹ Second, the logistics of randomization can be complicated in

community-based injury prevention programs. Certain interventions such as legislation may defy randomization at the community level and require a comparison at a state or country level.

Thirty-two trials that evaluated the effect of a community-based injury control intervention on child injury rates, safety behaviors, or the use of safety devices were identified in this review.^{2–33} This article focuses on the 28 studies targeting bicycle helmet use, automobile restraint use, pedestrian safety, general injury prevention, and adolescent alcohol use and vehicle safety (see Tables 1 to 5). The four other trials were aimed at reducing the frequency of play with guns,³⁰ reducing football injuries,³¹ improving road safety behaviors of bicyclists,³² and improving burn prevention practices.³³ Because only one study addressed each of these outcomes and none of the interventions had a positive impact, these studies are not discussed further in this review. Of the 28 remaining studies, 6 were RCTs,^{2,3,17,21,22,28} and 22 were nonrandomized controlled trials.^{4–16,18–20,23–27,29} Most of the studies examined safety behaviors; only four examined actual injuries.^{12,23–25}

The Effectiveness of Community-Based Approaches

Overall, the impact of community-based interventions on child and adolescent safety practices and injuries is mixed. Relatively strong evidence suggests that such interventions can increase bicycle helmet and motor vehicle restraint use among children. However, the success of these interventions at improving child pedestrian safety, influencing adolescent alcohol use and vehicle safety, and reducing rates of a broad array of childhood injuries within communities is less evident.

Elements of Successful Community-Based Approaches

Successful community-based programs share a number of common elements. The use of multiple strategies consistent with an underlying theory of behavior change is critical to success (see Box 1).^{34–36} Interventions are more effective when they are integrated into the community and when approaches are tailored to address unique community

characteristics such as ethnicity or socioeconomic status. Effective programs actively involve community stakeholders in the program-development process or hold public consultations to determine a program's process and goals. As a program is spread across a community, its impact may be increased by peer pressure and modeling by other community members.

In addition to successful programmatic elements, the design of community-based trials and the evaluation methodology used also influence program effectiveness. The most informative and reliable results come from RCTs (see the article by DiGiuseppi

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and Roberts in this journal issue). When randomization of groups to intervention and control conditions is not possible, comparison communities should be carefully selected that are similar to the intervention community in characteristics—such as socioeconomic status, age, race/ethnicity, and baseline use of safety behaviors—that may be associated with the effectiveness of the program.

The outcomes that were measured also influence the interpretation of a program's effectiveness; therefore, injury rates should be used whenever possible. However, measuring safety behaviors may be a suitable alternative when evidence shows that adoption of the behavior (that is, bicycle helmet use) is strongly associated with a decrease in injury rates (that is, head injury). Less rigorous outcomes, such as changes in knowledge or attitudes, should be avoided since the correlation between knowledge, attitudes, and behaviors can be weak.³⁷ Finally, regardless of the outcomes selected, assessment of program effectiveness requires careful and thorough statistical analyses to control for spurious effects due to repeated measures over time or bias.

Box 1

Selected Health Behavior Frameworks Used in Community-Based Interventions^a

■ **Health Belief Model:**³⁴ States that an individual's readiness to alter behavior depends on four conditions: (1) perceived threat or susceptibility to the condition; (2) perceived severity of the condition; (3) perceived benefits of the health action in reducing susceptibility and/or the severity of the condition, weighed against; (4) perceived barriers or personal costs of the health action. According to the Health Belief Model, community-based interventions should be designed to convince the target population of the threat of injury and their risk while simultaneously instilling confidence that a particular action is effective in reducing their risk.

■ **Social Learning Theory:**³⁵ Recognizes that behavior change occurs within a social context and is influenced by both active involvement in the learning process and identified consequences of the behavior change. Strategies such as modeling behavior (that is, having someone physically demonstrate the desired behavior) and promoting external reinforcement (for example, offering money) or internal reinforcement (for example, instilling a feeling of pleasure or pride) are key to successful behavior change. The ways in which social groups alter behavior support social learning theory; members change their behavior as a result of modeling or reinforcement by others, or by their own active involvement in the group.

■ **PRECEDE Model:**³⁶ Stands for Predisposing, Reinforcing, and Enabling Constructs in Educational Diagnosis and Evaluation. The three constructs work together toward behavioral change. Predisposing factors include attitudes, beliefs, and values of the target population. Reinforcing factors include support for behavior change, such as support from family, peers, teachers, or health care providers. Continuance of a behavior relies on reinforcement. Enabling factors consist of the individual skills necessary to adopt the proposed change, as well as the availability and accessibility of external resources to facilitate change. The educational diagnosis is the examination of predisposing, enabling, and reinforcing factors in the specific context of the proposed behavioral change. Evaluation is the quantification of the program's impact.

^a See related endnotes at the end of this article.

Summarized below is the impact of community-based interventions on child and adolescent safety practices and injury outcomes based on this systematic review (see Tables 1 to 5). Results from specific studies are discussed if they substantially contribute to the knowledge of the effectiveness of community-based interventions in general or if they illustrate critical aspects of a particular program that influenced the program's success or failure.

Programs Targeting Bicycle Helmet Use

Bicycle injuries are a leading cause of injury death and disability among children.³⁷ Bicycle-related head injuries result in approximately one-third of emergency department visits,

two-thirds of hospitalizations, and three-fourths of deaths related to bicycling (see the article by Grossman in this journal issue).³⁸ Several studies have shown that helmet use decreases the risk of head injury by 70% to 88%.³⁸⁻⁴³

Eleven community-based programs aimed at increasing the use of bicycle helmets by children and adolescents were identified in this review (see Table 1).²⁻¹³ Eight studies, representing seven different programs, reported a significant increase in helmet use,^{2,4-7,9-11} and one study reported a significant decrease in serious bicycle-related injuries¹² associated with the intervention in at least some subgroups examined. Two studies found no difference in helmet use

following the intervention,^{3,8} and one study reported no difference in self-reported risk-taking behaviors.¹³ A common element of successful programs was the use of multiple strategies targeted at different audiences to address three pivotal barriers to helmet use: lack of awareness about the risks of bicycling and the effectiveness of helmets, the cost of helmets, and the perception of negative peer pressure regarding helmet use. Use of multiple strategies allows a program to tackle more than one barrier to behavior change and to target more than one sub-population within the community. The result is a broad reception of the main campaign message, which is reinforced because it is sent and received in several ways.

An RCT conducted in Ontario, Canada, illustrates how multiple strategies can be used in a community-based program aimed at increasing bicycle helmet use among children and how the effects of each strategy can be examined in combination and separately.² Three schools similar in socioeconomic status and catchment area were randomly assigned to one of the following conditions: no intervention, an educational program aimed at increasing awareness of the importance of bicycle helmet use, or the educational awareness program plus a subsidy that allowed helmets to be purchased at a discounted price.

Baseline observations revealed that none of the children in any of the schools wore bicycle helmets. One month after the program, 22% of the children in the education-plus-subsidy school were observed wearing helmets, but none of the children in the other groups had adopted this safety practice. These findings indicate that an educational intervention supplemented by a subsidy to decrease financial barriers was successful at increasing helmet use in this population.

Although educational strategies coupled with economic incentives are often successful at increasing bicycle helmet use, their effectiveness may vary by the intensity and duration of the intervention. That is, the presence of multiple strategies is a necessary, but not always sufficient, condition to ensure a successful program. For example, Towner and colleagues developed an elementary school-based intervention with multiple

components.³ Discount coupons toward the purchase of bicycle helmets also were provided. However, although helmet ownership increased in the study group following the intervention (13% preintervention versus 27% postintervention), ownership increased similarly in the control group (19% preintervention versus 28% postintervention). Thus, the increase cannot be attributed to the intervention. In addition, the program failed to increase helmet use in the targeted schools, perhaps because it was short in duration and intensity.

Legislation is another strategy that has been paired with educational campaigns in community-based interventions. In Howard County, Maryland, legislation was passed that requires children under 16 years of age

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to wear helmets when riding bicycles on county roads and paths. An educational campaign also was adopted that included both school and community components. The combined effect of legislation and education in Howard County was compared with the effect of education alone in adjacent Montgomery County in two separate evaluations.^{4,5} A third community, Baltimore County, served as a control community, where no formal educational or legislative efforts were in place.

One evaluation found that approximately 10 months after the legislation went into effect, there was a significant increase in observed helmet use in the target population (4% preintervention versus 47% postintervention).⁴ Although observed helmet use also increased following the educational intervention in Montgomery County (8% preintervention versus 19% postintervention), this

Table 1

Community-Based Bicycle Injury Prevention Studies																									
Author(s), ^a Year, and Country	Study Design ^b	Study Population	Intervention	Key Study Results ^c																					
Morris ² 1991 Canada	RCT	Target group: • Parents/caregivers • Children grades K–8 Control group: • Randomized school in same city	<ul style="list-style-type: none"> • School-based education • Economic incentive 	Primary outcome measure: Helmet use <table border="1"> <thead> <tr> <th></th> <th>Pre</th> <th>Post</th> </tr> </thead> <tbody> <tr> <td>Target group:</td> <td></td> <td></td> </tr> <tr> <td>Education only</td> <td>0%</td> <td>0%</td> </tr> <tr> <td>Education and subsidy</td> <td>0%</td> <td>22%</td> </tr> <tr> <td>Control group</td> <td>0%</td> <td>0%</td> </tr> </tbody> </table> <ul style="list-style-type: none"> • Increase in the education and subsidy group only (p<.05) 		Pre	Post	Target group:			Education only	0%	0%	Education and subsidy	0%	22%	Control group	0%	0%						
	Pre	Post																							
Target group:																									
Education only	0%	0%																							
Education and subsidy	0%	22%																							
Control group	0%	0%																							
Towner ³ 1992 United States	RCT	Target group: • Parents/caregivers • Elementary school-children Control group: • Randomized school in same city	<ul style="list-style-type: none"> • School-based education • Economic incentive 	Primary outcome measure: Helmet use <table border="1"> <thead> <tr> <th></th> <th>Pre</th> <th>Post</th> <th>Four months</th> </tr> </thead> <tbody> <tr> <td>Target group</td> <td>0.57%</td> <td>2.67%</td> <td>1.37%</td> </tr> <tr> <td>Control group</td> <td>3.5%</td> <td>4.2%</td> <td>6.1%</td> </tr> </tbody> </table> Helmet ownership <table border="1"> <thead> <tr> <th></th> <th>Pre</th> <th>Post</th> </tr> </thead> <tbody> <tr> <td>Target group</td> <td>13%</td> <td>27%</td> </tr> <tr> <td>Control group</td> <td>19%</td> <td>28%</td> </tr> </tbody> </table> <ul style="list-style-type: none"> • No effect on helmet use • Increase in helmet use in both groups (p<.05) 		Pre	Post	Four months	Target group	0.57%	2.67%	1.37%	Control group	3.5%	4.2%	6.1%		Pre	Post	Target group	13%	27%	Control group	19%	28%
	Pre	Post	Four months																						
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	Pre	Post																							
Target group	13%	27%																							
Control group	19%	28%																							
Cote ^{4,d} 1992 United States	NRCT	Target group: • Parents/caregivers • Children under 16 years of age Control group: • Adjacent counties	<ul style="list-style-type: none"> • Education only: - School-based education - Public/parent education • Legislation and education 	Primary outcome measure: Helmet use (self-reported) <table border="1"> <thead> <tr> <th></th> <th>Pre</th> <th>Post</th> </tr> </thead> <tbody> <tr> <td>Target group:</td> <td></td> <td></td> </tr> <tr> <td>Education only</td> <td>8.4%</td> <td>12.6%</td> </tr> <tr> <td>Education and law</td> <td>11.4%</td> <td>37.5%</td> </tr> <tr> <td>Control group</td> <td>6.7%</td> <td>11.1%</td> </tr> </tbody> </table> <ul style="list-style-type: none"> • Increase in the education and law community (p<.0001) 		Pre	Post	Target group:			Education only	8.4%	12.6%	Education and law	11.4%	37.5%	Control group	6.7%	11.1%						
	Pre	Post																							
Target group:																									
Education only	8.4%	12.6%																							
Education and law	11.4%	37.5%																							
Control group	6.7%	11.1%																							
Dannenberg ^{5,d} 1994 United States	NRCT	Target group: • Parents/caregivers • Children grades 4 through 9 Control group: • Randomly selected schools in adjacent counties	<ul style="list-style-type: none"> • Education only: - School-based education - Public/parent education • Legislation and education 	Primary outcome measure: Helmet use (observed) <table border="1"> <thead> <tr> <th></th> <th>Pre</th> <th>Post</th> </tr> </thead> <tbody> <tr> <td>Target group:</td> <td></td> <td></td> </tr> <tr> <td>Education only</td> <td>8%</td> <td>19%</td> </tr> <tr> <td>Education and law</td> <td>4%</td> <td>47%</td> </tr> <tr> <td>Control group</td> <td>19%</td> <td>4%</td> </tr> </tbody> </table> <ul style="list-style-type: none"> • Increase in the education and law community (p<.0001) 		Pre	Post	Target group:			Education only	8%	19%	Education and law	4%	47%	Control group	19%	4%						
	Pre	Post																							
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Table 1 (continued)

Community-Based Bicycle Injury Prevention Studies																									
Author(s), ^a Year, and Country	Study Design ^b	Study Population	Intervention	Key Study Results ^c																					
DiGuseppi ⁶ 1989 United States	NRCT	Target group: • Parents/caregivers • Children ages 5 to 15 Control group: • City with same characteristics	<ul style="list-style-type: none"> • School-based education • Public/parent education • Economic incentive 	<p>Primary outcome measure: Helmet use</p> <table border="1"> <thead> <tr> <th></th> <th>Pre</th> <th>12 months</th> <th>16 months</th> </tr> </thead> <tbody> <tr> <td>Target group</td> <td>5.5%</td> <td>10.5%</td> <td>15.7%</td> </tr> <tr> <td>Control group</td> <td>1.0%</td> <td>—</td> <td>2.9%</td> </tr> </tbody> </table> <ul style="list-style-type: none"> • Increase in target group (p<.001) 		Pre	12 months	16 months	Target group	5.5%	10.5%	15.7%	Control group	1.0%	—	2.9%									
	Pre	12 months	16 months																						
Target group	5.5%	10.5%	15.7%																						
Control group	1.0%	—	2.9%																						
Parkin ⁷ 1993 Canada	NRCT	Target group: • Parents/caregivers • Children ages 5 to 14 Control group: • Schools matched on grade, SES	<ul style="list-style-type: none"> • School-based education • Public/parent education • Economic incentive 	<p>Primary outcome measure: Helmet use</p> <table border="1"> <thead> <tr> <th></th> <th>Pre</th> <th>Post</th> </tr> </thead> <tbody> <tr> <td>Target group:</td> <td></td> <td></td> </tr> <tr> <td> High income</td> <td>4%</td> <td>36%</td> </tr> <tr> <td> Low income</td> <td>1%</td> <td>7%</td> </tr> <tr> <td>Control group:</td> <td></td> <td></td> </tr> <tr> <td> High income</td> <td>4%</td> <td>15%</td> </tr> <tr> <td> Low income</td> <td>3%</td> <td>13%</td> </tr> </tbody> </table> <ul style="list-style-type: none"> • Increase in high-income group only (p<.001) 		Pre	Post	Target group:			High income	4%	36%	Low income	1%	7%	Control group:			High income	4%	15%	Low income	3%	13%
	Pre	Post																							
Target group:																									
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Low income	3%	13%																							
Parkin ⁸ 1995 Canada	NRCT	Target group: • Parents/caregivers • Children ages 5 to 14 Control group: • Schools in same region	<ul style="list-style-type: none"> • School-based education • Public/parent education • Economic incentive 	<p>Primary outcome measure: Helmet use</p> <table border="1"> <thead> <tr> <th></th> <th>Pre</th> <th>Post</th> </tr> </thead> <tbody> <tr> <td>Target group:</td> <td></td> <td></td> </tr> <tr> <td> Low income</td> <td>4%</td> <td>18%</td> </tr> <tr> <td>Control group:</td> <td></td> <td></td> </tr> <tr> <td> Low income</td> <td>3%</td> <td>19%</td> </tr> </tbody> </table> <ul style="list-style-type: none"> • Overall increase across groups (p<.001) • No effect of the intervention (p>.05) 		Pre	Post	Target group:			Low income	4%	18%	Control group:			Low income	3%	19%						
	Pre	Post																							
Target group:																									
Low income	4%	18%																							
Control group:																									
Low income	3%	19%																							
Farley ⁹ 1996 Canada	NRCT	Target group: • Parents/caregivers • Children ages 5 to 12 Control group: • Children the same age from municipalities in another region	<ul style="list-style-type: none"> • School-based education • Public/parent education • Economic incentive 	<p>Primary outcome measure: Helmet use (observed)</p> <table border="1"> <thead> <tr> <th></th> <th>Pre</th> <th>Post</th> </tr> </thead> <tbody> <tr> <td>Target group:</td> <td></td> <td></td> </tr> <tr> <td> High income</td> <td>10.9%</td> <td>33.7%</td> </tr> <tr> <td> Low income</td> <td>3.1%</td> <td>25.8%</td> </tr> <tr> <td>Control group:</td> <td></td> <td></td> </tr> <tr> <td> High income</td> <td>2.8%</td> <td>11.8%</td> </tr> <tr> <td> Low income</td> <td>4.1%</td> <td>15.2%</td> </tr> </tbody> </table> <ul style="list-style-type: none"> • Overall increase in target group (p<.001) • Interaction high income versus low income (p<.01) 		Pre	Post	Target group:			High income	10.9%	33.7%	Low income	3.1%	25.8%	Control group:			High income	2.8%	11.8%	Low income	4.1%	15.2%
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Author(s), ^a Year, and Country	Study Design ^b	Study Population	Intervention	Key Study Results ^c																				
Liller ¹⁰ 1995 United States	NRCT	Target group: • Parents/caregivers • Children grades K–2 Control group: • Schools matched on grade, SES	<ul style="list-style-type: none"> • School-based education • Public/parent education • Economic incentive 	Primary outcome measure: Helmet use <table border="1"> <thead> <tr> <th></th> <th>Pre</th> <th>Post</th> </tr> </thead> <tbody> <tr> <td>Target group</td> <td>8.5%</td> <td>32%</td> </tr> <tr> <td>Control group</td> <td>8.5%</td> <td>10%</td> </tr> </tbody> </table> <ul style="list-style-type: none"> • Increase in target group (p<.01) 		Pre	Post	Target group	8.5%	32%	Control group	8.5%	10%											
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Target group	8.5%	32%																						
Control group	8.5%	10%																						
Moore ¹¹ 1990 New Zealand	NRCT	Target group: • Children ages 11 to 13 Control group: • Schools matched on size, SES	<ul style="list-style-type: none"> • School-based education 	Primary outcome measure: Helmet use <table border="1"> <thead> <tr> <th></th> <th>Pre</th> <th>Post</th> </tr> </thead> <tbody> <tr> <td>Target group</td> <td>3.5%</td> <td>33.3%</td> </tr> <tr> <td>Control group</td> <td>6.3%</td> <td>10.9%</td> </tr> </tbody> </table> <ul style="list-style-type: none"> • Increase in target group (p<.01) 		Pre	Post	Target group	3.5%	33.3%	Control group	6.3%	10.9%											
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Control group	6.3%	10.9%																						
Ekman ¹² 1997 Sweden	NRCT	Target group: • Parents/caregivers • Children ages 0 to 15 Control group: • Four control cities	<ul style="list-style-type: none"> • School-based education • Public/parent education • Economic incentive 	Primary outcome measure: Bicycle injuries leading to hospital inpatient care (annual change in rate) Target group: decrease 3.1% Control group: decrease 2.9%, 2.2%, 3.4%, 1.1% <ul style="list-style-type: none"> • Mean decrease in target group (p value not stated) 																				
Tenn ¹³ 1996 Canada	NRCT	Target group: • Adolescents grades 8, 9, and 10 Control group: • Same-age teenagers from the same city	<ul style="list-style-type: none"> • School-based education by peers • School-based education by health professional 	Primary outcome measure: Self-report of risk-taking behavior <table border="1"> <thead> <tr> <th></th> <th>Pre</th> <th>Post</th> <th>Follow-up</th> </tr> </thead> <tbody> <tr> <td>Target group:</td> <td></td> <td></td> <td></td> </tr> <tr> <td> Peer</td> <td>59.8%</td> <td>66.6%</td> <td>60.8%</td> </tr> <tr> <td> Health professional</td> <td>61.8%</td> <td>65.1%</td> <td>64.9%</td> </tr> <tr> <td>Control group</td> <td>74.7%</td> <td>72.2%</td> <td>65.1%</td> </tr> </tbody> </table> <ul style="list-style-type: none"> • No effect of intervention (p>.05) 		Pre	Post	Follow-up	Target group:				Peer	59.8%	66.6%	60.8%	Health professional	61.8%	65.1%	64.9%	Control group	74.7%	72.2%	65.1%
	Pre	Post	Follow-up																					
Target group:																								
Peer	59.8%	66.6%	60.8%																					
Health professional	61.8%	65.1%	64.9%																					
Control group	74.7%	72.2%	65.1%																					

^a See the related endnotes at the end of this article.
^b RCT=randomized controlled trial; NRCT=nonrandomized study using a pre/post design with a comparison group.
^c A p value of less than .05 indicates that the difference between groups being compared is statistically significant.
^d Studies are different evaluations of the same intervention.



PHOTO OMITTED

increase was not statistically significant. In Baltimore County, use actually decreased somewhat during the same time period (19% preintervention versus 4% postintervention). In the second evaluation, fourth-, seventh-, and ninth-grade students from randomly selected schools in the three counties were asked about helmet use before and one year after the Howard County law went into effect.⁵ Although self-reported helmet use increased in all three counties, the increase was greatest in Howard County. One year following the legislative mandate, schoolchildren in Howard County were 2.3 times more likely to report helmet use on the most recent ride than children in the other two counties. Thus, the combined effect of legislation and education increased helmet use more than education alone.

The Seattle Bike Helmet campaign is another example of a comprehensive community-based trial that used multiple strategies to increase helmet use.⁶ This campaign had three specific objectives: to increase parental awareness of the need to wear a helmet when bicycling, to change peer pressure to make helmets “cool,” and to reduce financial barriers to purchasing a helmet. Financial barriers were reduced by distributing 100,000 helmet discount coupons to families through physician offices, schools, youth

groups, and community events. In addition, 1,300 helmets were sold at cost through the Parent-Teacher Association, and another 1,300 were donated to low-income children.

The Seattle campaign was successful at increasing observed helmet use among children ages 5 to 15, from a baseline rate of 5.5% to nearly 16%, 16 months following the intervention. During the same time period, observed helmet use among 5- to 15-year-olds remained stable in the control community of Portland, Oregon. Since the 16-month campaign follow-up in Seattle, the observed rate of helmet use among children has increased even more, reaching 60% in 1998. This increase in helmet use was accompanied by a two-thirds reduction in bicycle-related head injuries in the target population.⁴⁴

Although these studies indicate that the use of multiple strategies within a community-based intervention increased helmet use, other studies have found that the impact of comprehensive community-based programs varies substantially with the socioeconomic status of the target population.⁴⁵ In particular, some community-based interventions aimed at increasing bicycle helmet use among children have been effective in high-income, but not low-income, communities.⁷⁻⁹

This is especially discouraging since children in low-income communities are often at higher risk for unintentional injuries.⁴⁵ The studies discussed below illustrate the importance of targeting economic barriers in a community as part of a community-based approach.

A series of evaluations were conducted of “Be Bike Smart,” a program that promotes bicycle helmet use among children ages 5 to 14 in low- and high-income schools in a suburb of Toronto, Canada.^{7,8} This weeklong multiple-strategy program included classroom teaching, peer presentations, and celebrity appearances to encourage helmet use among

broader strategies may be necessary to overcome barriers to helmet use in low-income communities.

In summary, results from the studies included in this systematic review indicate that community-based efforts can effectively increase bicycle helmet use among children. To maximize the likelihood of success, efforts should be targeted broadly to increase parents’ awareness of the importance of helmet use, overcome resistance to helmet use by educating children, subsidize helmet costs, and pass regional legislation enforcing bicycle helmet use.

Even when these approaches are adopted, helmet use among children may not be increased in all circumstances, and different interventions may be required for different populations. For example, low-income communities may be more difficult to influence with community-based bicycle injury prevention programs. Regardless of community socioeconomic status, however, a common thread through several of these studies was the influence of peer pressure and modeling by adults. Children were more likely to wear a bicycle helmet if their friends also wore a helmet or if they were with an adult who also wore a helmet. This effect is consistent with social learning theory, which recognizes modeling and peer group behaviors as both stimuli and active reinforcers of behavior change.³⁵

Despite the positive impact of numerous community-based interventions on children’s bicycle helmet use, the design of these evaluations and the limited outcomes explored suggest that caution is warranted when interpreting these results. Importantly, only two RCTs of community-based helmet promotion programs were included in this review. In addition, nearly all studies focused on helmet ownership or use; only one looked at actual injuries.¹² Future research should investigate the importance of bicycle paths and general bicycle safety measures.

Programs Targeting Motor Vehicle Restraint Use

In 1996, motor vehicle occupant injuries resulted in the deaths of 4,970 children and adolescents in the United States. Child passenger restraints for infants and young children, and adult shoulder-lap belts used

A common thread through several of these studies was the influence of peer pressure and modeling by adults. Children were more likely to wear a bicycle helmet if their friends also wore a helmet or if they were with an adult who also wore a helmet.

children. Parents were targeted via mailings and were invited to school activities. In conjunction with this educational program, bicycle helmets were sold at a 20% discount off the regular price.⁷ In a subsequent “Be Bike Smart” campaign conducted only in low-income schools, the discount was raised to 75% to further minimize financial barriers.⁸

Following both programs, children across groups—regardless of whether or not they received the intervention—demonstrated an increase in observed helmet use. However, the intervention had a statistically significant effect on helmet use only in one subgroup: High-income children in the program that combined educational activities with a 20% helmet discount were more likely to wear a helmet following the intervention than were children in the control group (36% versus 15%, respectively). The lack of an intervention effect in low-income communities was attributed to perceived dangers or impracticalities of bicycling in high-density areas, differing belief systems, and financial and language barriers. Thus, results from the “Be Bike Smart” evaluations indicate that additional reinforcement or

correctly by children older than eight years of age, substantially reduce the probability of serious injury or fatality (see the article by Grossman in this journal issue).⁴⁶ Although child safety restraint legislation has been passed in all 50 states, restraints are used for only about 85% of infants and 60% of toddlers.⁴⁷ Furthermore, a large proportion of children are incorrectly restrained in car seats, and car seats are often installed incorrectly in vehicles.⁴⁸

This review identified five community-based studies aimed at increasing motor vehicle restraint use among children¹⁴⁻¹⁷ or adolescents¹⁸ (see Table 2). (Interventions focused on increasing infant car seat use are primarily delivered in clinical settings and are discussed in the article by DiGiuseppi and Roberts in this journal issue). Findings from these studies indicate that multiple-strategy programs that educate preschoolers, and programs that rely on parent education in concert with coercive techniques, can increase child motor vehicle restraint use. However, interventions may benefit more from the “carrot” than the “stick” approach to behavior change. Targeting children’s behavior directly is particularly important, because child motor vehicle restraint use is often inhibited when a child resists being restricted in a child safety seat and a weary parent succumbs to this resistance. Some of the most successful community-based interventions aimed at increasing child safety restraint use focus primarily on increasing compliance among children, with the theory that children may be trained to serve as monitors of the family’s motor vehicle restraint behaviors.

The “Bucklebear” preschool-based curriculum, designed to increase child motor vehicle restraint use among preschool-age children in California, focused primarily on children to effect behavior change.¹⁴ Six preschools that adopted this curriculum were compared with seven control preschools before they implemented the program and again three weeks after implementation. The program was successful, as evidenced by a significant increase in safety seat use among children in the intervention group (22% preintervention versus 44% postintervention) with no change among controls (22% preintervention versus 24% postintervention).

<http://www.futureofchildren.org>

The Children’s Traffic Safety Program in Tennessee is another school-based program aimed at increasing children’s motor vehicle restraint use by targeting children and their parents with a public education campaign.¹⁵ The program was based on the premise that if young children (grades K–12) are taught to adopt safety behaviors, they can then influence motor vehicle restraint use within their family. A community education campaign that included television, radio, and newspaper features and public service announcements ran parallel to the 10-week school-based curriculum. Control schools within the same district did not receive the intervention. In addition to evaluating the

Some of the most successful community-based interventions aimed at increasing child safety restraint use focus primarily on increasing compliance among children, with the theory that children may be trained to serve as monitors of the family’s motor vehicle restraint behaviors.

effect of the program on motor vehicle restraint use, researchers also examined the variation in impact by socioeconomic status and the quality of program implementation at each school.

Program effectiveness was influenced by both the quality of program implementation and socioeconomic status. Observed safety restraint use increased significantly only in low-income schools with good program implementation (13% preintervention versus 25% postintervention), measured 5 to 14 days after the intervention. In other intervention and control schools, the difference in motor vehicle restraint use before and after the intervention was not significant.

Findings from this trial highlight the critical importance of both program implementation and the target population to a program’s success. If program coordinators/teachers are not adequately trained or do not present the program in the manner in which it was designed, the impact may be diminished. Results from this trial mirror those

Table 2

Community-Based Child Motor Vehicle Restraint Studies																									
Author(s), ^a Year, and Country	Study Design ^b	Study Population	Intervention	Key Study Results ^c																					
Chang ¹⁴ 1985 United States	NRCT	Target group: • Parents/caregivers • Preschool children Control group: • Preschools matched on educational philosophy and size	<ul style="list-style-type: none"> • Preschool-based education • Parent activities/education 	Primary outcome measure: Child restraint use <table border="0"> <thead> <tr> <th></th> <th>Pre</th> <th>Post</th> </tr> </thead> <tbody> <tr> <td>Target group</td> <td>21.9%</td> <td>44.3%</td> </tr> <tr> <td>Control group</td> <td>22.1%</td> <td>23.8%</td> </tr> </tbody> </table> <ul style="list-style-type: none"> • Increase in target group (p<.001) 		Pre	Post	Target group	21.9%	44.3%	Control group	22.1%	23.8%												
	Pre	Post																							
Target group	21.9%	44.3%																							
Control group	22.1%	23.8%																							
Hazinski ¹⁵ 1995 United States	NRCT	Target group: • Parents/caregivers • Children grades K–2 Control group: • Schools within same school system	<ul style="list-style-type: none"> • School-based program • Community education program 	Primary outcome measure: Seat belt use <table border="0"> <thead> <tr> <th></th> <th>Pre</th> <th>Post</th> </tr> </thead> <tbody> <tr> <td>Target group:</td> <td></td> <td></td> </tr> <tr> <td> Low income/good program</td> <td>13%</td> <td>25%</td> </tr> <tr> <td> Low income/poor program</td> <td>15%</td> <td>16%</td> </tr> <tr> <td> High income/good program</td> <td>49%</td> <td>50%</td> </tr> <tr> <td> High income/poor program</td> <td>68%</td> <td>55%</td> </tr> <tr> <td>Control group</td> <td>48%</td> <td>55%</td> </tr> </tbody> </table> <ul style="list-style-type: none"> • Increase only for low-income schools with good program implementation (p=.01) 		Pre	Post	Target group:			Low income/good program	13%	25%	Low income/poor program	15%	16%	High income/good program	49%	50%	High income/poor program	68%	55%	Control group	48%	55%
	Pre	Post																							
Target group:																									
Low income/good program	13%	25%																							
Low income/poor program	15%	16%																							
High income/good program	49%	50%																							
High income/poor program	68%	55%																							
Control group	48%	55%																							
Bowman ¹⁶ 1987 Australia	NRCT	Target group: • Parents/caregivers • Children ages 3 to 5 Control group: • Preschools in same area	<ul style="list-style-type: none"> • Preschool-based education • Coercive strategy aimed at parents 	Primary outcome measure: Child restraint use <table border="0"> <thead> <tr> <th></th> <th>Pre</th> <th>Post</th> </tr> </thead> <tbody> <tr> <td>Target group:</td> <td></td> <td></td> </tr> <tr> <td> Coercive</td> <td>59.9%</td> <td>62.8%</td> </tr> <tr> <td> Educational</td> <td>60.6%</td> <td>75.0%</td> </tr> <tr> <td>Control group</td> <td>59.9%</td> <td>60.3%</td> </tr> </tbody> </table> <ul style="list-style-type: none"> • Increase in educational target group (p=.009) 		Pre	Post	Target group:			Coercive	59.9%	62.8%	Educational	60.6%	75.0%	Control group	59.9%	60.3%						
	Pre	Post																							
Target group:																									
Coercive	59.9%	62.8%																							
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Control group	59.9%	60.3%																							

Table 2 (continued)

Community-Based Child Motor Vehicle Restraint Studies																			
Author(s), ^a Year, and Country	Study Design ^b	Study Population	Intervention	Key Study Results ^c															
Stuy ¹⁷ 1993 United States	RCT	Target group: <ul style="list-style-type: none"> • Parents/caregivers • Children ages two to six Control group: <ul style="list-style-type: none"> • Matched, randomized day care in the same city 	<ul style="list-style-type: none"> • Coercive parent strategy • Parent education • Preschool education 	Primary outcome measure: Seat belt use <table border="0"> <thead> <tr> <th></th> <th>Pre</th> <th>Post</th> </tr> </thead> <tbody> <tr> <td>Target group</td> <td>54%</td> <td>75%</td> </tr> <tr> <td>Control group</td> <td>20%</td> <td>30%</td> </tr> </tbody> </table> <ul style="list-style-type: none"> • Increase in use for both groups pre/post observation (p<.01) and between centers at post (p<.05) 		Pre	Post	Target group	54%	75%	Control group	20%	30%						
	Pre	Post																	
Target group	54%	75%																	
Control group	20%	30%																	
Neuwelt ¹⁸ 1989 United States	NRCT	Target group: <ul style="list-style-type: none"> • High school students Control group: <ul style="list-style-type: none"> • High school students in the same city 	<ul style="list-style-type: none"> • Educational 	Primary outcome measure: Seat belt use <table border="0"> <thead> <tr> <th></th> <th>Pre</th> <th>Post</th> </tr> </thead> <tbody> <tr> <td>Target group</td> <td>22.3%</td> <td>29%</td> </tr> <tr> <td>Control group</td> <td>42%</td> <td>49%</td> </tr> </tbody> </table> Knowledge <table border="0"> <tbody> <tr> <td>Target group</td> <td>7.6%</td> <td>8.4%</td> </tr> <tr> <td>Control group</td> <td>7.5%</td> <td>7.7%</td> </tr> </tbody> </table> <ul style="list-style-type: none"> • No effect of intervention on seat belt use (p>.05) • Increase in knowledge in target group (p<.01) 		Pre	Post	Target group	22.3%	29%	Control group	42%	49%	Target group	7.6%	8.4%	Control group	7.5%	7.7%
	Pre	Post																	
Target group	22.3%	29%																	
Control group	42%	49%																	
Target group	7.6%	8.4%																	
Control group	7.5%	7.7%																	

^a See the related endnotes at the end of this article.
^b RCT=randomized controlled trial; NRCT=nonrandomized study using a pre/post design with a comparison group.
^c A p value of less than .05 indicates that the difference between groups being compared is statistically significant.

observed in bicycle helmet promotion trials, reported earlier, in terms of differential impact across socioeconomic status. However, whereas community-based programs to increase bicycle helmet use were generally more effective in high-income communities, this trial had a greater impact in low-income communities. This variation in results may be attributed to the much lower baseline rates of restraint use in low-income than high-income schools in this study, which allowed more room for improvement. Despite the fact that low-income children demonstrated a significant increase in motor vehicle restraint use,

sufficient deterrent, and a more visible police presence may be necessary.

A positive approach to changing the safety behavior of parents may have a greater impact on child safety restraint use than coercive tactics. In an RCT aimed at increasing child safety restraint use, Stuy and colleagues sought to alter the behavior of parents by requiring them to sign a policy statement in which they agreed to comply with state laws and day-care center recommendations regarding child safety restraint use.¹⁷ Based on the tenets of social learning theory, Stuy and colleagues hypothesized that this program “buy-in” would help foster a sense of membership in a social group and that parents would alter their behavior as a result of modeling or reinforcement by other members or because of their own active involvement in the group. This strategy was combined with a comprehensive educational safety program in the school.

A positive approach to changing the safety behavior of parents may have a greater impact on child safety restraint use than coercive tactics.

their postintervention use (16% to 25%) still was lower than the baseline use among high-income children (49% to 68%).

A community-based trial in Australia compared the effect of coercive tactics aimed at parents with an educational approach aimed at children.¹⁶ The coercive intervention threatened parents with random police checks and fines, and it reminded them of legislation mandating child safety restraint use. The educational intervention relied on kits used by educators to teach preschool children the importance of wearing automobile safety restraints. The rationale for teaching children was that this information would “filter up” to the parents and further increase the use of child restraints.

Observations before and two weeks after the intervention revealed that only the educational approach was effective at increasing automobile safety restraint use among preschoolers (61% preintervention versus 75% postintervention). Use did not increase in either the control or the coercive intervention groups. It was postulated that the coercive intervention failed to impact safety restraint use because it did not deal with the fact that children often resist being restrained. In addition, the mere threat of police involvement may not have been a

Child safety restraint use increased significantly following the intervention in both the intervention (54% preintervention versus 75% postintervention) and the control (20% preintervention versus 30% postintervention) groups. Although child care centers were randomly assigned to the intervention or control conditions, some differences between the groups are worth noting. Specifically, the control centers had fewer white families, more single-parent families, and more families with an annual income of less than \$15,000. It is unlikely that these differences substantially influenced the findings, however, and this “positive” approach was successful at increasing child safety restraint use. It also may be a less costly alternative to the coercive approach described above, since it does not require visible enforcement.

Only one trial in this review, The Oregon Head and Spinal Cord Injury Prevention Program, was aimed at increasing shoulder and lap belt use among adolescents through an educational campaign.¹⁸ This program relied on a single strategy—providing emotionally charged information at a high school assembly to change knowledge, attitudes, and behaviors regarding seat belt use.

The effectiveness of the program was measured by observed seat belt use and questionnaire measures of knowledge and

attitudes taken two weeks before and two weeks after the intervention. The intervention was not associated with changes in seat belt use or attitudes toward use. Only knowledge about the importance of seat belt use increased following the intervention. This may be of little consequence, however, given the weak relationship between changes in knowledge and changes in injury behavior.³⁷ Another study of this curriculum implemented in Washington State also found no consistent change in knowledge, attitudes, or seat belt use associated with the intervention.⁴⁹ Consistent with other community-based programs, these findings suggest that single, one-time interventions to change behavior are not successful.

In summary, several community-based interventions delivered in day-care or school settings have increased motor vehicle restraint use among young children. The use of multiple strategies to promote behavior change and a focus on increasing children's acceptance of motor vehicle safety seats appear critical to a program's success. Additional well-designed RCTs of community-based interventions that use these strategies would be useful to corroborate the findings of the numerous nonrandomized studies reported in this article. Rigorous community-based studies focusing on motor vehicle restraint use among adolescents also are needed.

Pedestrian Safety Interventions

Pedestrian injuries among children and youths accounted for nearly 19% of all pedestrian deaths in 1996 (see the article by Grossman in this journal issue). Preschool-age children are at particular risk, as they lack the ability to judge the safety of street crossings and may be inadequately supervised by their parents.

Four community-based studies aimed at reducing child pedestrian injuries met the inclusion criteria for this systematic review. These studies all targeted children between the ages of three and six in school²⁰⁻²² or home¹⁹ settings (see Table 3). Two of these were RCTs that measured children's traffic safety behavior in simulated environments; they reported marginal²¹ or no improvement associated with the interventions.²² The two nonrandomized studies of child pedestrian interventions focused on parents

as supervisors and facilitators of children's behavior change.^{19,20} Both studies found that with appropriate training, parents or other adults can positively impact children's traffic safety behavior. However, the one study that reported numeric data found that even after the intervention nearly three-quarters of children still ran ahead of their parents near traffic, and participating parents did not differ from control parents in the amount or quality of their supervision.¹⁹

In summary, results from this review indicate that the benefit of community-based education aimed at improving traffic safety behavior among young children is limited. The benefit of such interventions delivered in a simulated setting is marginal at best, and there is no evidence that children will

Developmentally, preschool-age children are not prepared to learn and react appropriately to traffic. Therefore, physically separating young children from traffic may be a more effective approach.

behave the same way in real-life settings. Although some evidence suggests that community-based interventions involving parents or other instructors as supervisors and facilitators can improve children's traffic safety behaviors, this improvement is modest, and even after training, young children remain at substantial risk for pedestrian injuries.

Developmentally, preschool-age children are not prepared to learn and react appropriately to traffic.⁵⁰ Therefore, physically separating young children from traffic may be a more effective approach. Uncontrolled evaluations of environmental approaches to reducing pedestrian injuries—such as by lowering speed limits, using speed bumps and signs, or narrowing roads—have been conducted, primarily in Europe, and are promising.⁵¹⁻⁵³ Future investigations using rigorous methodological designs are necessary to quantify the benefits or shortcomings of environmental approaches, because they are gaining popularity over educational interventions.

Table 3

Community-Based Pedestrian Injury Prevention Studies													
Author(s), ^a Year, and Country	Study Design ^b	Study Population	Intervention	Key Study Results ^c									
West ¹⁹ 1993 England	NRCT	Target group: • Parents/caregivers • Children ages 3 1/2 to 4 Control group: • Same-age schools in neighboring counties	<ul style="list-style-type: none"> • Home-based education • Parent facilitation in learning 	Primary outcome measure: Road safety behaviors <i>Run ahead</i> <table border="1"> <thead> <tr> <th></th> <th>Pre</th> <th>Post</th> </tr> </thead> <tbody> <tr> <td>Target group</td> <td>82.3%</td> <td>74.3%</td> </tr> <tr> <td>Control group</td> <td>79.4%</td> <td>79.9%</td> </tr> </tbody> </table> <ul style="list-style-type: none"> • Improvement in target group (p<.01) • No change in parent supervision behaviors (p>.05) 		Pre	Post	Target group	82.3%	74.3%	Control group	79.4%	79.9%
	Pre	Post											
Target group	82.3%	74.3%											
Control group	79.4%	79.9%											
Rothengatter ²⁰ 1984 Netherlands	NRCT	Target group: • Parents/caregivers • Children ages 4 to 6 Control group: • Same-age schools in same area	<ul style="list-style-type: none"> • School-based education • Instruction by: <ul style="list-style-type: none"> - Parent - Assistant 	Primary outcome measure: Safety behavior in traffic <ul style="list-style-type: none"> • Improved target group performance crossing on quiet streets, between parked cars, and at junctions (p<.01) • No differences between parent and assistant training (p>.05) 									
Renaud ²¹ 1989 Canada	RCT	Target group: • Children age 5 Control group: • Randomized children in same class into four groups	<ul style="list-style-type: none"> • School-based education <ul style="list-style-type: none"> - Attitude simulation - Behavior simulation - Both attitude and behavior simulation 	Primary outcome measure: Actions taken during a quasi-real-life traffic setup <ul style="list-style-type: none"> • Intervention groups did marginally better on measures of attitude, behavior, and transfer (p value not stated) 									
Nishioka ²² 1991 Japan	RCT	Target group: • Children ages 4 to 6 Control group: • Kindergarten programs in same city	<ul style="list-style-type: none"> • School-based education 	Primary outcome measure: Safety behavior in simulated traffic <ul style="list-style-type: none"> • No differences in observed behaviors regardless of presence vs. absence of a running motorcycle and detailed vs. vague verbal instructions (p>.05) 									

^a See the related endnotes at the end of this article.
^b RCT=randomized controlled trial; NRCT=nonrandomized study using a pre/post design with a comparison group.
^c A p value of less than .05 indicates that the difference between groups being compared is statistically significant.

General Safety Campaigns

This article has discussed community-based studies, each focused on a specific type of injury. However, a major strength of the community-based approach is the opportunity to target more than one type of injury within a community. Four nonrandomized community-based trials were found that used general safety campaigns to target multiple child-injury problems (see Table 4).²³⁻²⁶ Three of these used changes in injury rates as a measure of program effectiveness, though only one trial reported statistically significant decreases in injury rates associated with the intervention.²³ General safety campaigns differ from other community-based interventions in that they tend to be long term and adapted over time to meet community needs. The success of these interventions largely relies on input from community members and community ownership of program activities.

The Safe Kids/Healthy Neighborhoods Coalition illustrates how a successful community-based intervention grows and changes within a community.²³ This program, implemented in the Harlem neighborhood of New York City, was aimed at reducing a variety of childhood injuries resulting from outdoor activities. The initiative was started because parents and educators in central Harlem requested a program in playground safety from health professionals. Surveys of playgrounds revealed that they were being used by drug dealers and were in poor repair, and that children using playgrounds had little adult supervision. The Harlem Hospital Injury Prevention Program, in collaboration with a variety of community groups and city agencies, started the Safe Kids/Healthy Neighborhoods Coalition with the following goals: (1) to renovate central Harlem playgrounds; (2) to involve children and adolescents in safe, supervised activities that teach useful skills; (3) to provide injury and violence prevention education; and (4) to provide safety equipment (for example, bicycle helmets) at reasonable cost. During the first three years of the program, 26 organizations participated in the coalition, and different programs and activities were developed.

The effectiveness of this community-based coalition was evaluated by examining

changes in injury rates in the targeted age group (5- to 16-year-olds) for injuries targeted by the campaign (for example, all injuries related to vehicles, outdoor falls, assaults, and guns) over nine years (1983 to 1991). These rates were compared with changes in the rates of nontargeted injuries (that is, poisoning, burns, and so on) and changes in injury rates in a comparison community (the suburb of Washington Heights) during the same time period.

Targeted injuries were reduced by an estimated 44% during the intervention period, with no significant decrease for nontargeted injuries; this decrease was noted

General safety campaigns differ from other community-based interventions in that they tend to be long term and adapted over time to meet community needs. The success of these interventions largely relies on input from community members and community ownership of program activities.

mainly in the targeted age group. Unexpectedly, a 30% decline in severe injuries among school-age children also was observed in Washington Heights. However, the decline in Washington Heights occurred in both targeted (motor vehicle injuries only) and nontargeted categories. Whether this reduction in motor vehicle injuries observed in the comparison community occurred independently of the intervention, or whether the effect of the Safe Kids/Healthy Neighborhoods Coalition “spilled over” into Washington Heights, could not be ascertained. Notwithstanding this concurrent change in the control community, the authors concluded that the specific decrease in targeted injuries within the targeted age group in central Harlem demonstrated a positive effect of the intervention.

A second general injury prevention campaign, the Lidköping Accident Prevention Programme (LAPP), was associated with a modest, though not significant, rate decrease in injuries leading to hospital admission.²⁴ Nonetheless, the comprehensiveness of the

Table 4

Community-Based General Injury Prevention Studies				
Author(s), ^a Year, and Country	Study Design ^b	Study Population	Intervention	Key Study Results ^c
Davidson ²³ 1994 United States	NRCT Bicycle, car collision, pedestrian, falls, firearm	Target group: • Parents/caregivers • Children ages 5 to 16 Control group: • Different health region in same city	<ul style="list-style-type: none"> • School-based education • Engineering and environmental improvements • Economic incentives • Community activities (sports, arts) 	Primary outcome measure: Targeted injury rates presented to hospital Target group: Postintervention decrease of 50% Control group: Postintervention decrease of 30% • Decrease in target group for target injuries ($p < .001$)
Svanstrom ²⁴ 1995 Sweden	NRCT Unintentional injuries	Target group: • Parents/caregivers of children younger than 14 years of age Control group: • (i) 4 other municipalities and (ii) bordering county that uses same hospital	<ul style="list-style-type: none"> • Community programs <ul style="list-style-type: none"> - Surveillance - Provision of information - Training - Supervision - Environmental improvements 	Primary outcome measure: Injury rates leading to hospital admissions Target group: Decrease of 2.1% (girls); 2.4% (boys) Control groups: Increase of 2.2% (girls); 0.6% (boys) Decrease of 0.3% (girls); 1% (boys) • No differences between groups ($p > .05$)
Schlesinger ²⁵ 1997 United States	NRCT "Accidental" injuries	Target group: • Parents/caregivers of children ages 0 to 7 Control group: • Similar geographical area within school district	<ul style="list-style-type: none"> • Parent and community education 	Primary outcome measure: Injury rates based on hospital, physician, and dentist reports • No consistent difference in trends between groups ($p > .05$)
Sundelin ²⁶ 1996 Sweden	NRCT Bicycle, poisoning, pedestrian, falls, fire/burn, suffocation	Target group: • Parents/caregivers • Children from 6 months to 6 years of age Control group: • Randomly chosen heads of households from other municipalities	<ul style="list-style-type: none"> • Television programs • Parent information on the program and encouragement to watch the series 	Primary outcome measure: Number of two-parent families who watched at least one program Target group: 59% Control group: 43% • No differences between groups with respect to the number of programs watched or the number of safety behaviors undertaken ($p > .05$)

^a See the related endnotes at the end of this article.
^b RCT=randomized controlled trial; NRCT=nonrandomized study using a pre/post design with a comparison group.
^c A p value of less than .05 indicates that the difference between groups being compared is statistically significant.

strategies used and the collaborative approach adopted illustrate critical components of promising general safety campaigns.

LAPP was developed by a community health unit in an effort to plan and coordinate health and safety in Lidköping, Sweden. The program included five elements: (1) surveillance of inpatient and outpatient injuries; (2) information, such as telephone hotlines and bicycle safety campaigns; (3) training of coaches, child care staff, and parents in first aid or other injury prevention areas; (4) supervision, including municipal safety; and (5) environmental improvements, such as improving gym floors to decrease slipping injuries. Key to this campaign was the involvement of representatives from existing community organizations, municipal administrations, welfare services, and the Red Cross, as well as community professionals such as engineers, nurses, teachers, and police.

The impact of LAPP was evaluated by measuring decreases in rates of injuries leading to hospital admissions over nine years (1983 to 1991). During this time, there was an average annual decrease in hospital admissions in the intervention group of 2.4% for boys and 2.1% for girls, without a similar decrease in neighboring comparison municipalities. These differences were not significant, and many methodological limitations were associated with the intervention, such as changes in recording procedures at the hospitals and inconsistent implementation during the early years of the program.

In summary, findings from general community-based safety campaigns are mixed at best. Only the Safe Kids/Healthy Neighborhoods Coalition has reported statistically significant decreases in targeted injuries, and even in this study it is questionable whether the decrease in injury rates can be wholly attributed to the intervention. Nonetheless, general safety campaigns that adopt a broad array of strategies and garner support from numerous community constituencies are promising.

Future general safety campaigns should rely on these strategies and employ rigorous study designs to evaluate program impact. RCTs may not be possible since the

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success of these broad-based programs likely depends on an impetus for change that comes from community constituencies, as with the Safe Kids/Healthy Neighborhoods Coalition. Thus, randomly assigning a community to receive the intervention, whether or not the community expresses a desire for change, may diminish program success. Nevertheless, careful selection of a comparison community that is similar to the intervention community with respect to characteristics associated with the injury outcomes of interest, but distant enough in proximity to avoid “spill over” effects, is critical. Evaluation of general safety campaigns also requires carefully standardized data coding that is narrow enough to capture the different components of the program, yet broad enough to ensure that data collection is manageable. Finally, more sophisticated data analyses are required so that possible confounds, such as variations in time, are statistically controlled.

Programs Targeting Adolescent Alcohol Use and Vehicle Safety

Motor vehicle collisions are a major cause of death and disability in youths, with alcohol playing an important role in many instances (see the article by Grossman in this journal issue).⁵⁴ Although interventions are needed to alter unsafe adolescent driving behaviors, risk-oriented behaviors common among teenagers make this a difficult challenge. Peer pressure also is a powerful motivator among adolescents, and individual behavior change often is predicated on behavior change in one's peer group.

This review identified three community-based programs aimed at decreasing alcohol misuse and reckless driving among teenagers (see Table 5).²⁷⁻²⁹ All three programs were delivered as part of a high school

Although interventions are needed to alter unsafe adolescent driving behaviors, risk-oriented behaviors common among teenagers make this a difficult challenge.

educational curriculum; only one was an RCT.²⁸ While all programs reported that the intervention increased knowledge of the risks of consuming alcohol and operating a motor vehicle, only one trial found a change in behavior (self-reported increased seat belt use when riding as a passenger) associated with the intervention.²⁹ Because the link between knowledge, attitudes, and subsequent behaviors is tenuous at best,³⁷ interventions that affect the first two domains, but do not influence behavior change, should be viewed with caution.

Newman and colleagues developed an innovative program, "Resisting Pressures to Drink and Drive," designed to teach ninth-grade students the physiological effects of alcohol, myths about alcohol use, and skills to resist peer pressure to drink.²⁷ Students from nine schools were assigned to either the "Resisting Pressures to Drink and Drive" intervention group or to a control group that received the traditional alcohol education program. Increases in students' knowledge associated with the intervention were observed after the first year of the program.

The intervention was not successful, however, at changing behaviors (that is, reducing the rate of riding with a driver who has been drinking), changing teenagers' perceived ability to resist peer pressure, or reducing alcohol consumption. In fact, both alcohol consumption and the number of occurrences of riding with a driver who had been drinking increased over time in both groups.

A second school-based curriculum was aimed at preventing alcohol use among 10th grade students in nine Michigan high schools by preparing them to cope effectively with peer pressures to misuse alcohol.²⁸ Classes within each school were randomly assigned to either the intervention or control groups, with the intervention delivered by trained teachers during five sessions. A significant increase in knowledge about alcohol, its physiological effects, and resisting pressure to drink was observed in the intervention group following the intervention and again in 12th grade, with no change among controls. However, despite this sustained gain in knowledge, self-reported alcohol misuse and driving a motor vehicle after drinking still increased over time among students in both groups.

A similar program aimed at improving vehicle safety included a weeklong module on injury control and crash safety information in a high school physics course.²⁹ The intervention covered forms of energy, injury prevention, car safety features, types of vehicular collisions, seat belts, and g forces, as well as hands-on activities. At baseline, the groups were similar in terms of knowledge, self-reported seat belt use, speeding, and driving under the influence of alcohol. Two years following the intervention, however, knowledge, reported seat belt use when riding as a passenger, and intention of always wearing a seat belt were significantly higher in the intervention group. Despite the positive behavioral change reflected in seat belt use—which increased from 70% to 80% in the intervention group, but only 67% to 70% among controls—this study suffered from notable limitations. These included differential dropout of risk takers (that is, teenagers most inclined to drive fast, drive after drinking one to two alcoholic beverages, and not wear a seat belt)

Table 5

Adolescent Alcohol Use and Vehicle Safety Studies																												
Author(s), ^a Year, and Country	Study Design ^b	Study Population	Intervention	Key Study Results ^c																								
Newman ²⁷ 1992 Canada	NRCT	Target group: • Adolescents in grade 9 Control group: • Junior high schools in the same school system	• High school-based educational curriculum	Primary outcome measure: Drinking and driving knowledge and safety behaviors <i>Knowledge</i> <table border="1"> <thead> <tr> <th></th> <th>Pre</th> <th>Post</th> </tr> </thead> <tbody> <tr> <td>Target group</td> <td>13.5</td> <td>17.71</td> </tr> <tr> <td>Control group</td> <td>12.9</td> <td>15.22</td> </tr> </tbody> </table> <ul style="list-style-type: none"> • Increased knowledge in target group (p<.000) • No effect on reducing the rate of riding with a driver who has been drinking, perceived ability to resist pressure, or changing alcohol consumption (p>.05) 		Pre	Post	Target group	13.5	17.71	Control group	12.9	15.22															
	Pre	Post																										
Target group	13.5	17.71																										
Control group	12.9	15.22																										
Shope ²⁸ 1996 United States	RCT	Target group: • Adolescents in grade 10 Control group: • Randomized class, same grade and school	• High school-based educational curriculum	Primary outcome measure: Drinking and driving knowledge and safety behaviors <i>Knowledge</i> <table border="1"> <thead> <tr> <th></th> <th>Pre</th> <th>Grade 10</th> <th>Grade 12</th> </tr> </thead> <tbody> <tr> <td>Target group</td> <td>63.4</td> <td>72.3</td> <td>71.8</td> </tr> <tr> <td>Control group</td> <td>63.4</td> <td>64.8</td> <td>69.3</td> </tr> </tbody> </table> <i>Drinking and driving</i> <table border="1"> <thead> <tr> <th></th> <th>Pre</th> <th>Grade 10</th> <th>Grade 12</th> </tr> </thead> <tbody> <tr> <td>Target group</td> <td>0.09</td> <td>0.16</td> <td>0.60</td> </tr> <tr> <td>Control group</td> <td>0.10</td> <td>0.13</td> <td>0.69</td> </tr> </tbody> </table> <ul style="list-style-type: none"> • Higher knowledge scores with intervention (p<.001) • Nonsignificant increase of driving after drinking with age (p>.05) 		Pre	Grade 10	Grade 12	Target group	63.4	72.3	71.8	Control group	63.4	64.8	69.3		Pre	Grade 10	Grade 12	Target group	0.09	0.16	0.60	Control group	0.10	0.13	0.69
	Pre	Grade 10	Grade 12																									
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Target group	0.09	0.16	0.60																									
Control group	0.10	0.13	0.69																									
Martinez ²⁹ 1996 United States	NRCT	Target group: • Adolescents in grades 10, 11, and 12 Control group: • Two high school physics classes matched for SES factors in the same city	• High school-based educational curriculum	Primary outcome measure: Seat belt use knowledge and safety behaviors <i>Knowledge</i> <table border="1"> <thead> <tr> <th></th> <th>Pre</th> <th>Grade 10</th> <th>Grade 12</th> </tr> </thead> <tbody> <tr> <td>Target group</td> <td>0.67</td> <td>0.94</td> <td>0.89</td> </tr> <tr> <td>Control group</td> <td>0.72</td> <td>0.77</td> <td>0.75</td> </tr> </tbody> </table> <i>Seat belt use as a passenger</i> <table border="1"> <thead> <tr> <th></th> <th>Pre</th> <th>Grade 10</th> <th>Grade 12</th> </tr> </thead> <tbody> <tr> <td>Target group</td> <td>70%</td> <td>83%</td> <td>80%</td> </tr> <tr> <td>Control group</td> <td>67%</td> <td>58%</td> <td>70%</td> </tr> </tbody> </table> <ul style="list-style-type: none"> • Increase in knowledge with intervention (p=.00) • Increased use of seat belts with intervention (p=.01) 		Pre	Grade 10	Grade 12	Target group	0.67	0.94	0.89	Control group	0.72	0.77	0.75		Pre	Grade 10	Grade 12	Target group	70%	83%	80%	Control group	67%	58%	70%
	Pre	Grade 10	Grade 12																									
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^a See the related endnotes at the end of this article.
^b RCT=randomized controlled trial; NRCT=nonrandomized study using a pre/post design with a comparison group.
^c A p value of less than .05 indicates that the difference between groups being compared is statistically significant.

between follow-up assessments, and scores on drinking and driving attitudinal questions that left little room for improvement.

In summary, alcohol use among adolescents is a difficult behavior to modify, and community-based programs aimed at reducing the likelihood that adolescents will drive or ride with a driver under the influence of alcohol have been unsuccessful. In fact, results from these studies show that adolescent alcohol consumption actually increases with age, and increased knowledge regarding alcohol misuse negatively correlates with subsequent alcohol-related behavior.

The failure of these studies to influence adolescent behavior may reflect interventions that were poorly designed for this age group.

Community-based programs aimed at reducing the likelihood that adolescents will drive or ride with a driver under the influence of alcohol have been unsuccessful.

Because modeling peer group behaviors is so important for teenagers, future community-based strategies should appeal to the ability of peer groups to facilitate changes in normative behavior. Differences within teenage peer groups also should be examined to determine whether certain groups are more amenable to change following different strategic interventions. It may be that different strategies need to be implemented for different peer groups to maximize program success. Teenagers who are involved in sports, for example, may respond most favorably to interventions that focus on the potential detrimental effects of alcohol on athletic performance. Alternatively, educating young women about the high caloric content of alcoholic beverages may have the greatest impact on their drinking behaviors. Because teenagers are in a unique developmental stage, in which they are testing boundaries, interventions also may be more successful if they provide additional rewards and incentives for adopting well-defined vehicle safety behaviors. Finally, future interventions should explore more innovative and less pedagogical

approaches to promote adolescent safety behaviors. Given the increased use of computer technology by youths, for example, Internet-based interventions should be tested as a potential venue for influencing adolescent safety behaviors.

Even if the effectiveness of community-based strategies can be improved by more carefully designed and executed interventions, programs that rely on educational strategies to alter adolescent behaviors are likely to be more successful when combined with regulatory or legislative approaches such as graduated licensure (see the article by Schieber, Gilchrist, and Sleet in this journal issue). A recent systematic review of graduated licensure found that this approach is likely to reduce motor vehicle crashes and crash-related injuries involving teenagers, although few evaluations of graduated licensing systems have been conducted.⁵⁵

Conclusions

Community-based interventions have been successful in some areas of childhood injury prevention. Specifically, the increased use of bicycle helmets and motor vehicle safety seats among children has been associated with effective community-based programs. For other injury areas—including child pedestrian safety, adolescent alcohol use and vehicle safety, and general safety campaigns—the benefit of community-based strategies is less evident. Lack of success in these areas may be attributed to poorly designed and implemented programs, inadequate research methodology, or the inherent inability of community-based strategies to alter safety practices or reduce injury outcomes. For some safety behaviors and target populations, such as motor vehicle restraint use among adolescents, well-designed programs that include multiple strategies and are grounded in an accepted theory of behavior change simply have not been tested in community settings. For other areas, such as pedestrian safety among young children, there is evidence that community-based educational interventions alone are insufficient to consistently alter young children's behavior in traffic situations. Community-based approaches focused on engineering modifications to increase road safety may be more effective, but have not been rigorously evaluated.

Future community-based interventions should adopt the key elements common among the successful programs in this systematic review. Education remains an important component of community-based injury prevention efforts. All too often, though, education is viewed in only one dimension: the didactic presentation of information to affect knowledge. The key assumption—that changes in knowledge automatically result in changes in behavior—is not supported by research. Instead, changes in knowledge must be accompanied by improved skill, changes in social norms, a supportive environment, and reinforcement that encourages behavior change. These aims may be difficult to achieve in community programs, especially given the limited time of most interventions.

In addition to education, effective programs use a broad array of other strategies and rely on existing community organizations and infrastructure, such as schools, the media, and/or sponsorship by private industry (that is, to reduce costs of safety devices). The selection of strategies should be based on previous evidence identifying factors most amenable to change. Finally, messages should be tailored to address as many community groups as possible within the target audience.

Perhaps the most important challenge in designing community-based interventions is the use of scientific evaluation. Recent evidence has established that nonrandomized designs yield an overestimation of benefit compared with randomized designs,⁵⁶ and many community interventions fail to employ randomization, even when this approach is feasible.¹ Randomization can be achieved by randomly assigning groups of individuals (for example, schools) or entire communities to control or intervention conditions. Cluster randomization, a technique that allows for randomization of communities, should be used more frequently.⁵⁷ It is only when such rigorous designs are used that society will be able to determine where best to invest resources in community-based interventions.

The community-based approach to injury prevention fits in well with the public health priority of improving the health of population groups. For communities to

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maximize the potential benefit of this approach, they must become active participants in injury prevention efforts. Many studies included in this systematic review indicate that community organizations have shown the commitment, the desire, and the ability to share the burden and responsibility for reducing childhood unintentional injuries. In consultation with community leaders and organizations, future studies should continue to test the effect of well-designed community-based approaches aimed at improving safety behaviors and reducing injuries among children and youths.

The authors wish to extend their gratitude to Jessie McGowan for the development of their search strategy.

Appendix

Methods Used for the Systematic Reviews

The search strategy was designed in conjunction with a research librarian to identify studies that examined the effectiveness of a community-based injury control intervention in decreasing injury rates or increasing behaviors that decrease injury rates in children and adolescents. A filter (that is, a series of subject-related keywords used to extract potentially relevant articles from computerized databases) for defining “community” was developed, tested, and included in the search strategies. Upon examining the results of the injury searches, it was apparent that not all potentially relevant articles were being identified. Two additional search strategies were developed, both including the community filter. As the age range varies for each database, we accounted for this by using text words to specify ages in addition to numerical ages.

Databases Searched

Eight electronic databases were searched for studies published in any language. The databases included MEDLINE (1966–98), EMBASE (1974–98), Psycinfo (1967–98), Current Contents (wk1–wk25), HealthSTAR (1975–98), Sportdiscus (1949–98), CINAHL (1982–98), and *The Cochrane Database of Systematic Reviews* (CDSR) (1998, Issue 2). Separate searches of each database were conducted for the following injury categories: (a) bicycle, walk, and motor vehicle; (b) gun, drown, and choke; (c) fall, burn, and electrocution; (d) poisoning and cuts; (e) sports and amputation. Detailed search strategies are available from the corresponding author. When references were retrieved by more than one database, priority in downloading was given to MEDLINE. The journal *Injury Prevention* from March 1995 to 1998 was searched by hand and four potentially relevant studies were identified. A fifth article was identified through an article found in MEDLINE. Two additional articles were selected based on expert opinion. However, due to time constraints, reference lists from relevant reviews were not examined for potential studies.

Once the search process was complete, two members of the research team screened each citation and available abstract in the database. For all databases, letters, comments, editorials, or articles on sunburn, abuse, and other intentional injuries were excluded. All references to injury in children or adolescents and those that used a study design that included a control group were tagged as potentially relevant. Articles were reviewed and assessed using eligibility criteria established by the team.

Inclusion/Exclusion Criteria

A study was included if: (1) it included a control group that did not receive the intervention; (2) the target population was between 0 and 19 years of age (if a greater age range was examined, separate data analysis had to be conducted for the 0 to 19 age group); (3) it examined the effectiveness of a community-based intervention based in a setting such as a recreational center, school, or day-care center and involved any intervention between an individual-based approach and a state or nationwide one; and (4) it reported injury rates or change in an injury-reducing behavior. Three members of the team independently reviewed all potentially relevant articles to determine the eligibility of each document. All disagreements were resolved by consensus.

Data Extraction

Pertinent information was extracted from each article by one member of the team using a Data Extraction Form (available upon request). To interpret the study, we attempted to extract the primary outcome of interest, the intervention used, and

Appendix (continued)

relevant data about the results. The primary outcome reports the effectiveness of the intervention and is used to determine which sample size to report for this study. If the primary outcome was unclear, the outcome which seemed to be the “most important” to eliminate bias was chosen. For example, if helmet ownership and helmet use were both outcomes, helmet use was selected. In cases where attitude, behavior, and knowledge were all examined, behavior was selected.

Following data extraction, quality assessment was conducted for each randomized controlled trial (RCT) and nonrandomized controlled trial (NRCT) using the Jadad Scale, a validated instrument designed to assess methodological quality.¹ Quality is scored between 0 and 5, with 5 being the highest score/quality. Three members of the team calibrated themselves on the instrument, and two independently completed quality assessments of each relevant study. Disagreements were resolved by consensus.

Results

A total of 1,236 citations were identified, of which 349 were duplicates, resulting in 887 articles. The initial screen identified 158 potentially relevant articles. Two articles were reviews, one was a meta-analysis, and the remaining 155 articles contained original data. Of the 155 articles that were potentially relevant, 28 were included in the review; 4 were not discussed further in this review, because they addressed other types of injury prevention (such as gun-playing); 5 were excluded and are discussed in the article by DiGuseppi and Roberts in this journal issue; 5 were unavailable through the library; 2 were in French; and 111 did not meet the eligibility criteria. More than half of the excluded articles did not contain a control and/or did not use a community-based intervention. Of the 28 studies discussed, 6 were RCTs and 22 were NRCTs.

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