

# Bicycle helmet use among schoolchildren

## *Impact of a community education program and a cycling fatality*

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**OBJECTIVE** To assess the effect of a community bicycle helmet education and subsidy program and the further effect of a bicycle rodeo on helmet ownership and use among elementary schoolchildren. The unanticipated effect of a child cyclist fatality was also measured.

**DESIGN** Helmet ownership and use were measured in two ways: a questionnaire was sent to all elementary schoolteachers asking about helmet ownership and use by their students; and volunteers counted the children riding their bicycles to school.

**SETTING** Elementary schools in the town of Goderich, population 7400, and the town of Kincardine, population 6227, both on Lake Huron in southwestern Ontario.

**PARTICIPANTS** More than 80% of the 1050 elementary school students in Goderich and, for comparison, more than 90% of the 1439 elementary school students in Kincardine.

**INTERVENTIONS** An extensive education campaign with programs, assemblies, teaching aids, speakers, and a colouring and poster contest, coupled with a discount helmet offer in October 1991. Incentives to helmet use, such as bicycle rodeos, took place in May 1992 and 1993. A child cyclist not wearing a helmet was fatally injured in September 1992.

**MAIN OUTCOME MEASURES** Teachers polled students on helmet use and student volunteers counted children riding bicycles and noted helmet use.

**RESULTS** A total of 250 helmets were purchased, and helmet use was observed to increase among 5- to 14-year-old children from 0.75% to 12.8% during 9 months. Program effect was significantly greater on younger children, and girls used helmets more often than boys did. The cycling fatality in Goderich was associated with a dramatic increase in helmet use (to more than 50%), a significantly higher rate than in Kincardine. A second subsidy and rodeo did not further increase helmet use.

**CONCLUSIONS** A small community with limited resources can mount a bicycle helmet education and incentive program with high exposure and participation rates by children. Despite an initial 17-fold increase in observed helmet use, more than 87% of cyclists still did not wear helmets. The cycling fatality was associated with a significant increase in helmet use.

**OBJETIF** Évaluer l'effet d'un programme communautaire éducatif comportant un incitatif financier sur le taux d'utilisation du casque de cyclisme et l'effet ultérieur d'un rodéo de bicyclette sur la possession et l'utilisation du casque protecteur chez des enfants fréquentant l'école élémentaire. L'impact imprévu du décès accidentel d'un jeune cycliste fut également mesuré.

**CONCEPTION** Deux méthodes pour mesurer la possession et l'utilisation du casque protecteur: un questionnaire envoyé à tous les enseignants de niveau élémentaire leur demandant d'interroger les étudiants sur la possession et l'utilisation du casque et l'implication d'un groupe de bénévoles pour assurer le décompte des enfants se rendant à l'école à bicyclette.

**CONTEXTE** Écoles élémentaires de la ville de Goderich, population de 7 400, et de la ville de Kincardine, population de 6 227, deux villes situées près du lac Huron dans le sud-ouest de l'Ontario.

**PARTICIPANTS** Plus de 80% des 1 050 étudiants fréquentant les écoles élémentaires de Goderich et, pour fins de comparaison, plus de 90% des 1 439 étudiants des écoles élémentaires de Kincardine.

**INTERVENTIONS** Une campagne intensive d'éducation comportant programmes, réunions, outils éducatifs, conférences et un concours d'affiches et de dessins, complétée en octobre 1991 par un rabais sur l'achat d'un casque protecteur. Pendant les mois de mai 1992 et mai 1993 se sont tenus des rodéos de bicyclette pour inciter les jeunes à porter le casque. Un jeune cycliste qui ne portait pas son casque a été blessé mortellement en septembre 1992.

**PRINCIPALES MESURES DES RÉSULTATS** Les enseignants ont procédé à un sondage sur l'utilisation du casque et des étudiants bénévoles ont fait le décompte des enfants utilisant la bicyclette et ont noté le taux d'utilisation du casque.

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**RÉSULTATS** Il s'est vendu 250 casques. Chez les 5-14 ans, l'utilisation du casque est passée de 0,75% à 12,8% au cours d'une période de 9 mois. Le programme a eu des effets significativement plus marqués chez les plus jeunes. Comparativement aux garçons, les filles portaient leur casque plus souvent. Suite au décès d'un jeune cycliste à Goderich, l'utilisation du casque s'est accrue de façon spectaculaire (à plus de 50%), pourcentage significativement plus élevé qu'à Kincardine. La répétition du rabais à l'achat d'un casque et du rodéo n'a pas modifié le taux d'utilisation du casque protecteur.

**CONCLUSIONS** Une petite communauté aux ressources limitées peut mettre sur pied un programme éducatif et incitatif favorisant le port du casque de cyclisme et obtenir des taux de participation et d'exposition élevés auprès des enfants. Malgré l'observation initiale à l'effet que le taux d'utilisation du casque s'était multiplié par 17, plus de 87% des cyclistes ne portaient toujours pas leur casque. Le décès du jeune cycliste s'est accompagné d'une augmentation significative de l'usage du casque protecteur.

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**I**N CANADA INJURIES CAUSE more than half of all deaths among children 5 to 14 years of age – more than all other causes combined.<sup>1,2</sup> The Ontario Coroner's records reveal that 15% of all blunt injury deaths of Ontario children are bicycle related.<sup>3</sup> During 1991 in Canada, 40 children died in bicycle accidents, most from head injuries.<sup>4</sup> The statistics are proportionally similar in the United States, where bicycling injuries to children and adolescents account for more than 500 000 emergency department visits and more than 500 deaths annually.<sup>5-10</sup>

Bicycle helmets decrease the risk of head injury in cycling accidents by at least 85% and brain injury by 88%.<sup>11</sup> Other studies support these figures.<sup>9,12,13</sup> In Victoria, Australia, legislated mandatory bicycle helmet use was associated with a 51% decrease in the number of cyclists killed or hospitalized with head injuries.<sup>14</sup> Yet most Canadians still do not wear helmets when cycling.<sup>2,15,16</sup>

A community program was undertaken in Goderich, Ont, with a goal of increasing children's use of bicycle helmets. Strategies included education about the importance of helmets, a helmet subsidy program, and incentives to helmet use to overcome barriers to wearing helmets.

This study was undertaken to assess the effect of the education and subsidy program and the further effect of a bicycle rodeo on helmet ownership and use.

## METHOD

### Setting

Goderich is a small town of 7400 people on Lake Huron in southwestern Ontario, and is the largest of five small towns in Huron County, one of the most rural counties in southern Ontario. It is a popular resort, and vehicular traffic is heavy during the summer months. It has three elementary schools (kindergarten to grade 8) and one secondary school (grades 9 to 13).

### Program

In summer 1991, an interest group was formed consisting of a family physician, police chief, community liaison police constable, public health nurse, recreation department director, businessman, journalist, lawyer, and school principals.

During the next 12 months, an energetic campaign was conducted, mainly in the town's three elementary schools. October 1991 was designated Bicycle Helmet Safety Month. A colouring and poster contest was held in all three schools. Information and posters on cycling and head injuries were distributed to the schools as teaching aids. The education campaign culminated in a bicycle helmet safety day in which all elementary students (kindergarten to grade 8) participated in assemblies at the secondary school. Each of the three age-related assemblies (primary [kindergarten to grade 2], junior [grades 3 to 5], and senior [grades 6 to 8]) had a guest speaker who was a former Canadian

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cycling squad member, cycling safety videos, short plays performed by the secondary school drama club, and presentation of the colouring and poster contest prizes. A public information meeting was held that evening, again at the secondary school. The local medical society, several service clubs, and local businesses sponsored the campaign.

In conjunction with these events, information sheets sent home from school and available at the recreation department advertised an order of helmets that were available at discount prices to all schoolchildren and the public. Canadian Injury Prevention Program helmets (sponsored by Sandoz and The Canadian Medical Association) were offered because they were less expensive than helmets available locally.

The following spring (May 1992), a bicycle rodeo was held during school hours at each of the elementary schools. Each rodeo included a written test on cycling safety rules, bicycle licensing, application of reflector tape to all bicycles lacking it, and a practical test of cycling skills (diminishing clearance, stopping distance, figure eight, and coping with intersections). Bonus points were obtained for wearing a bicycle helmet. An assembly was held at the end of the day to review test answers and practical skills, and to award prizes.

During the summer months, the police operated a spot check program, awarding prizes (T-shirts) to cyclists observed to be riding safely while wearing helmets. Articles in the local newspaper publicized the committee's activities and reinforced aspects of safe cycling, including the importance of helmets.

Table 1. Questionnaire for elementary schoolteachers

**Teachers, please complete the following questionnaire:**

Date: \_\_\_\_\_ School: \_\_\_\_\_

Teacher: \_\_\_\_\_ Grade: \_\_\_\_\_

Please ask the following questions and record by hand count:

1. Number of students present \_\_\_\_\_
2. Number of students who ride a bicycle \_\_\_\_\_
3. Number of students who own a bicycle helmet \_\_\_\_\_
4. Of these, number who almost always wear helmets when cycling \_\_\_\_\_
5. Number of students who rode their bicycles to school today \_\_\_\_\_
6. Of these, number who wore helmets to school \_\_\_\_\_

A tragic event occurred in September 1992 when a 9-year-old boy not wearing a helmet rode his bicycle through a stop sign one block from his home and was hit by a car. He died the next day of head injuries.

In May 1993, bicycle rodeos were again held at each school. A local retailer also offered a limited number of helmets at discount prices at two of the three schools.

**Parameters measured**

Cycling and helmet use were measured in two ways: all elementary school-teachers were asked to fill out questionnaires on cycling and helmet use by their students (*Table 1*) and trained student volunteers counted children riding their bicycles to school with and without helmets at each of the school bicycle racks. These counts were made during the same month (often during the same week) but not necessarily on the same day as the teacher questionnaires were completed. At the baseline (September 1991), counts were done on 2 separate days at each school. Because the counts were very similar,

data from the second day only were included. Subsequently, counts were done on 1 day only at each school. In most cases, two independent observers were used and their results averaged.

Teacher questionnaires and bicycle rack counts were done on five occasions:

- September 1991, before any intervention,
- April 1992, after the education campaign and helmet sale,
- June 1992, after the first bicycle rodeos,
- April 1993, after the cycling death at the start of the next cycling season, and
- June 1993, after the second helmet offer and bicycle rodeos.

The same teacher questionnaires and bicycle rack counts were used in Kincardine, Ont (population 6227), during April 1993, to compare results in a setting exposed to the same provincial initiatives and a more limited school program but without the rodeos and child cycling death.

*Table 2. Bicycle helmet ownership and use*

CHARACTERISTIC	BASELINE SEPT 1991 % (N)	AFTER EDUCATION AND HELMET SUBSIDY APRIL 1992 % (N)	AFTER RODEO JUNE 1992 % (N)	AFTER FATALITY APRIL 1993 % (N)	AFTER SECOND SUBSIDY AND RODEO JUNE 1993 % (N)	KINCARDINE COMPARISON COMMUNITY APRIL 1993 % (N)
Cyclists owning helmets	10.1 (80/790)	26.4 (236/895)	32.8 (270/824)	67.3 (627/931)	78.8 (624/792)	49.1* (607/1237)
Owners almost always wearing helmets	51.3 (41/80)	59.3 (140/236)	64.8 (175/270)	79.4 (498/627)	80.3 (501/624)	69.9* (424/607)
Cyclists reported wearing helmets today	0.98 (3/306)	9.4 (27/286)	12.7 (46/363)	56.3 (147/261)	52.1 (147/282)	19.1* (56/293)
Cyclists observed wearing helmets today	0.75 (2/265)	11.0 (31/283)	12.8 (34/266)	51.8 (147/284)	50.2 (143/285)	15.9* (46/289)

\* P < 0.001 in comparison with Goderich in April 1993.

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### Analysis

Significance levels were taken as  $P = 0.05$ . To compare helmet use in Goderich and Kincardine, use among girls and boys, and use at different grade levels, we used  $\chi^2$  tests. To compare ownership and use at different times, we used paired  $t$  tests on the differences of the proportions.

Table 3. Effect of education and subsidy program: Proportion of schoolchildren observed to be wearing helmets

SCHOOL	BASELINE SEPTEMBER 1991 % (N)	AFTER EDUCATION AND SUBSIDY APRIL 1992* % (N)	AFTER RODEO JUNE 1992† % (N)
1	0 (113)	8.66 (127)	9.62 (52)
2	.97 (103)	10.78 (102)	10.87 (138)
3	2.04 (49)	16.67 (54)	18.42 (76)

\* Paired  $t$  test compared with baseline:  $t = -6.033$ ,  $P = .026$ ,  $df = 2$ .

† Paired  $t$  test compared with baseline:  $t = -5.419$ ,  $P = .032$ ,  $df = 2$ .

Paired  $t$  test between April 1992 and June 1992:  $t = 1.947$ ,  $P = 0.191$ .

## RESULTS

A total of 250 helmets, ranging in size from toddler to adult, were purchased through the discount order in October 1991. Only 53 helmets were purchased in May 1993. Unlike the first order, the May order was available only to families in two of the three schools and not to the general public. Also, by May 1993, more affordable helmets were available locally.

The percentage of teachers completing the questionnaires was high (84% to 98%), consistently representing more than 80% of the children enrolled in the schools. A high proportion of the students polled (87% to 96%) rode bicycles. The proportion of cyclists who reported riding their bicycles to school on any particular day ranged from 24% to 44%.

Table 2 shows bicycle helmet ownership and use during the study. Helmet ownership increased steadily, doubling after the cycling fatality. The three measures of helmet use

(helmet owners who said they almost always wore their helmets, students who stated they wore helmets while cycling to school on the day of the study, and students observed wearing helmets) all increased after the education program and rodeo, and after the fatality. Helmet ownership continued to increase, but helmet use had leveled off by the end of the study (June 1993). Reported and observed helmet use were similar in all counts. The comparison town (Kincardine) had significantly lower helmet ownership and use in April 1993 (corrected  $\chi^2$  tests with  $P < 0.001$  for all variables measured).

Table 3 shows the effect of the education program and helmet subsidy before and after the first rodeo. The combination of education and helmet subsidy resulted in a statistically significant increase in helmet use. The bicycle rodeo resulted in a further increase, but it was insignificant.

Figure 1 shows results according to division: primary, junior, and senior. Age was inversely and significantly associated with helmet ownership and use and with response to the education and incentive program ( $P < 0.05$  for all measures of helmet ownership and use at all times, and  $P < 0.006$  for all except reported helmet use on the day of the baseline questionnaire in September 1991). Figure 2 shows observed helmet use among boys and girls. The proportion of helmet users was consistently higher among girls than among boys, but was significantly higher only in April 1993 (corrected  $\chi^2 = 9.38$ ,  $P = 0.0021940$ ).

## DISCUSSION

Bicycle helmet ownership and use increased dramatically during the program. The education, helmet subsidy, and rodeo resulted in only a modest increase, however. Our results compare favourably with education programs in larger centres

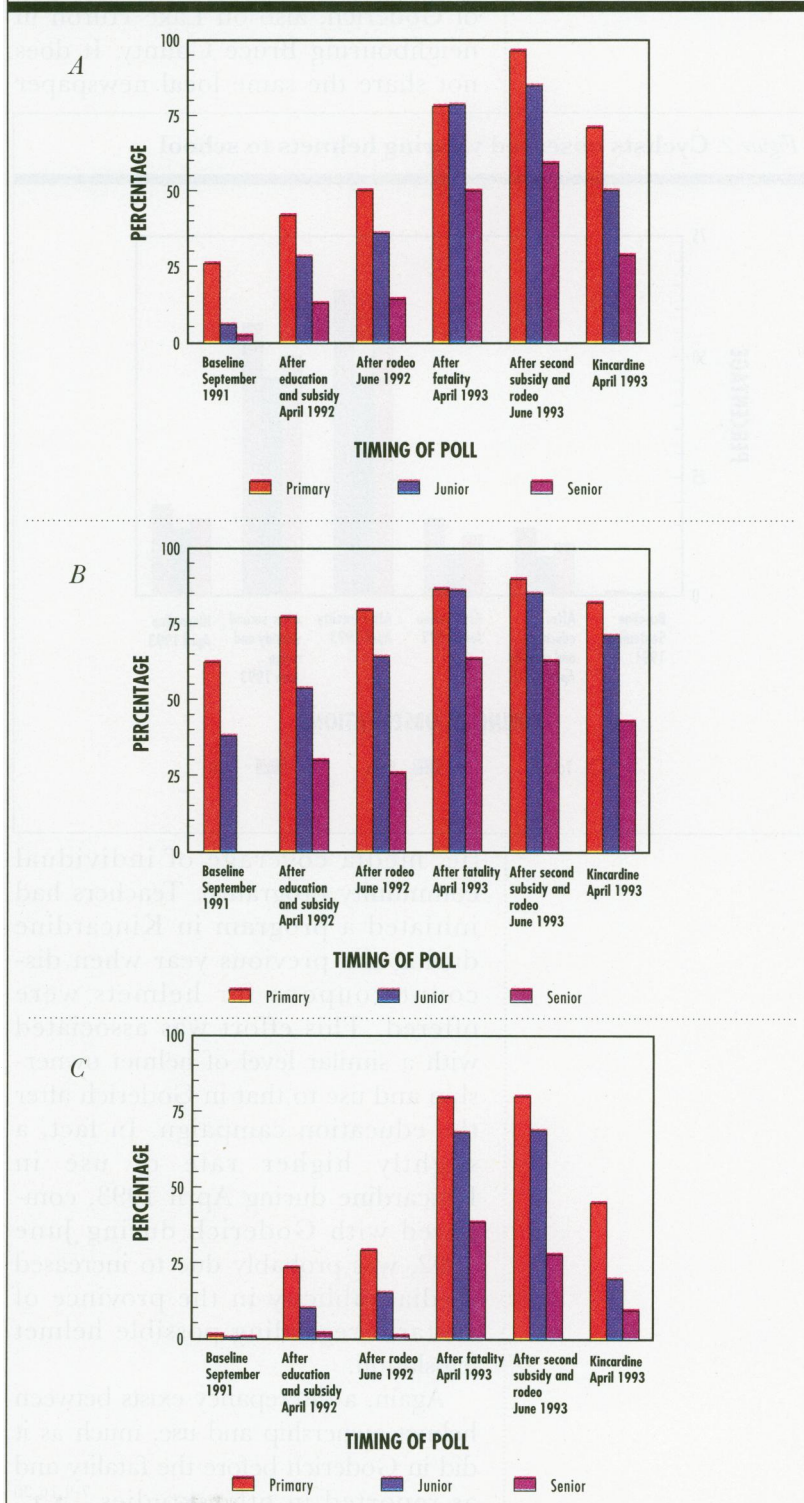
with much larger resources.<sup>2,6,17</sup> Despite a 17-fold increase in helmet use, the percentage of cyclists observed wearing helmets at the end of the first year of the campaign (June 1992) was still less than 13%. In other words, more than 87% of child cyclists were still not wearing helmets. This fact was tragically underscored by a cycling fatality 3 months later. Not surprisingly, the fatality was associated with a dramatic increase in helmet use, especially among older children (grades 6 to 8), on whom the education program had had little, if any, effect. Other studies corroborate this level of effect.<sup>6,10,18</sup>

Although helmet ownership continued to increase, helmet use seemed to have begun to level off between April and June 1993. This could be due to a fading over time of the frightening effect of the fatality as well as parental inconsistency in enforcing helmet use. Others have shown the need for periodic reinforcement to maintain helmet use.<sup>19</sup> Despite an intensive education program and helmet subsidy, repeated incentives (rodeos and spot checks), and a cycling fatality, observed helmet use was never much above 50%. The sobering reality is that, without mandatory helmet use, even a "successful" program can only have mediocre results. Other interventions are needed if higher rates of use are to be achieved. In July 1993, the Province of Ontario amended the Highway Traffic Act, making it mandatory for cyclists to wear approved bicycle helmets when cycling in Ontario as of October 1, 1995.

Until April 1993, the number of students reported and observed wearing helmets to school was much lower than anticipated, based on stated helmet ownership and usual use. This could be due to the count of customary helmet use being a result of students, particularly in the younger grades, wanting to "please" their teachers; the children who owned and wore helmets perhaps coming from

more safety-conscious families who were less likely to allow them to cycle to school; and the children who owned and wore helmets at the onset of the study being such a minority that they

Figure 1. Helmet use reported by cyclists: A) Cyclists who owned helmets, B) Helmet owners who reported always wearing helmets, C) Cyclists who reported wearing helmets on the day of survey



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were often teased and thus chose not to cycle to school. An increasing proportion of helmeted riders and the cycling fatality were forces that altered peer pressure.

It was very difficult to find a town with which to compare rates. Kincardine was chosen because it is a similar-sized community, 52 km north of Goderich, also on Lake Huron in neighbouring Bruce County. It does not share the same local newspaper

Although the Kincardine figures are comparable to the figures after the Goderich campaign, they are significantly lower than those in Goderich after the fatality. As stated earlier, education programs like those in Goderich and Kincardine can achieve helmet use of about 10% to 20%, but a fatality is associated with an increase in use to about 50%.

## CONCLUSION

Cycling is popular among children aged 5 to 14 years; up to 44% of student cyclists ride to school on any given day. With broad support from community leaders and the use of elementary schools as the base for the campaign, a small community with limited resources mounted a bicycle helmet education and incentive program with very high exposure and participation rates by children. This campaign resulted in a significant increase in the number of children observed wearing helmets while cycling to school. The success among elementary schoolchildren was inversely proportional to age and was slightly more successful among girls than among boys. Despite an initial 17-fold increase in observed helmet use (0.75% to 12.8%), more than 87% still did not wear helmets. A cycling fatality was associated with a significant increase (to more than 50%) in helmet use. Use subsequently leveled off, despite further subsidies and programs. If higher rates of use are to be achieved, other interventions, such as legislation, will be needed.<sup>14,21-23</sup> ■

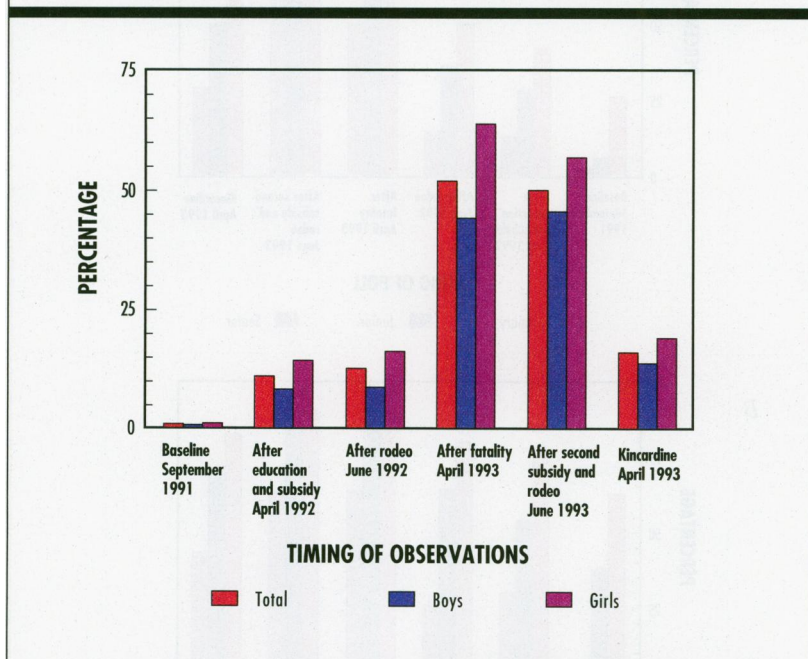
### Dedication

*I dedicate this article to Jonathan and his family.*

### Acknowledgment

*I thank the members of the Goderich Bicycle Helmet Safety Committee (now the Goderich Cycling Safety Committee), the local medical society, and the businesses and service clubs who sponsored the program. I thank Laura Robinson*

Figure 2. Cyclists observed wearing helmets to school



(ie, media coverage of individual community programs). Teachers had initiated a program in Kincardine during the previous year when discount coupons for helmets were offered. This effort was associated with a similar level of helmet ownership and use to that in Goderich after the education campaign. In fact, a slightly higher rate of use in Kincardine during April 1993, compared with Goderich during June 1992, was probably due to increased media publicity in the province of Ontario regarding possible helmet legislation.

Again, a discrepancy exists between helmet ownership and use, much as it did in Goderich before the fatality and as reported in other studies.<sup>7-9,16,20</sup>

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**Requests for reprints to:** Dr L.L. Rourke, 53 North St, Goderich, ON N7A2T5

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## The campaign

Both parent and child factors can be barriers to helmet ownership and use. Parental factors include lack of awareness of the need, cost, perception that their children would not wear the helmets, and procrastination.<sup>7</sup> Children's reasons centre on the importance of peer behaviour and pressure.<sup>6,7,20,24</sup> Other reasons include uncomfortable or unattractive helmets, lack of perceived need, and forgetting.<sup>7</sup> Studies suggest that parental education level, health- and safety-related attitudes and knowledge, parent or sibling helmet ownership, and previous bicycle injury to someone personally known are associated with increased helmet use.<sup>7-9,25</sup>

Elementary schoolchildren were targeted because they are a large population at risk (87% to 96% ride a bicycle and 28% to 44% of these cycle to school on any given day); they have more riding years at risk; they are more vulnerable to injury because they are less coordinated and safety conscious (especially those lacking knowledge of basic cycling rules<sup>26</sup>); and they are least likely to wear bicycle helmets.<sup>15</sup> They have also been shown to be more easily convinced to use helmets than secondary school students.<sup>6,10,18</sup>

Basing the program in the schools encouraged participation. Bicycle rodeos held in the same community several years before on Saturday mornings were attended only by a few highly motivated children, those least likely to need training in safe cycling. Use of the central sec-

ondary school for the assemblies allowed each to be geared to a particular age group. Walking to the secondary school and seeing secondary school students involved in comedy skits in the assemblies impressed the younger students.

Studies by Cushman and colleagues<sup>27,28</sup> have shown that routine promotion of helmet use by physicians in their offices or emergency departments has little effect. Community involvement was important; many community leaders were well-known to the children (eg, police, school principal, nurse, family doctor). The community's small size did not seem to be a barrier to the program's success. On the contrary, the lack of formal funding was balanced by a lack of bureaucratic "red tape" and a wealth of volunteer impetus and momentum.

Helmet subsidy programs can improve helmet use beyond educational programs alone.<sup>29</sup> Our first bulk discount helmet offer was successful, with 250 helmets ordered. The second bulk order was much smaller, partly because helmets were not as widely available, but also because fewer children were without helmets; those without helmets were less likely to be convinced of the need; and more competitively priced local helmets were available.

The fatality showed that safe cycling requires knowledge of, and adherence to, the rules of the road, not just the use of a helmet.



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