Trends in bicycle helmet use in Ottawa from 1988 to 1991

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Objective: To determine the prevalence rates of helmet use by cyclists in Ottawa in September 1991 and to compare them with the rates in a baseline survey conducted in September 1988.
Design: Observational survey.
Subjects: A total of 3252 cyclists (commuters, recreational cyclists and students in primary, secondary and postsecondary schools) were observed. In the baseline study 1963 such cyclists had been surveyed.
Results: In 1991, 1056 (32.5%) of the cyclists were observed wearing helmets. After the samples were standardized for varying size across the cyclist groups the total helmet use was found to have increased from 10.7% in 1988 to 32.2% in 1991. The highest increase in the rate of helmet use was found among the commuters (from 17.9% in 1988 to 44.6% in 1991); the rate had increased from 14.3% to 31.1% among the recreational cyclists and from 1.9% to 21.0% among the students. All of the trends were statistically significant ($p < 0.0001$). When the student population was subdivided the rate of helmet use was found to be 25% among the elementary school children, 17% among the secondary school students and 20.2% among the postsecondary school students.
Conclusions: The use of bicycle helmets in Ottawa has increased dramatically. Our experience, as well as evidence from other centres, indicates that specific interventions such as media coverage, bulk-buying projects in schools and discount coupons can accelerate the rate of helmet adoption. Although less than half of cyclists are wearing helmets the trend has acquired considerable momentum, and major gains are expected in the next few years. Nevertheless, resistance among young adults and the cost of helmets for low-income groups may be problems. These challenges call for the refinement of future promotional strategies.

Objectif : Déterminer les taux de prévalence de l'utilisation du casque par les cyclistes d'Ottawa en septembre 1991 et les comparer avec les taux d'une étude de base menée en septembre 1988.
Conception : Étude par observation.
Sujets : Au total, on a observé 3 252 cyclistes (navetteurs, randonneurs, et élèves et étudiants du primaire, du secondaire et du postsecondaire). Dans l'étude de base, on avait observé 1 963 cyclistes semblables.
Résultats : En 1991, on a observé 1 056 cyclistes (32,5 %) qui portaient le casque. Après la standardisation des échantillons en fonction des diverses tailles dans les groupes de cyclistes, on a constaté que l'utilisation totale du casque avait augmenté de 10,7 % en

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1988 à 32,2 % en 1991. L'augmentation la plus importante du taux d'utilisation du casque a été constatée chez les navetteurs (de 17,9 % en 1988 à 44,6 % en 1991); le taux a augmenté de 14,3 % à 31,1 % chez les randonneurs et de 1,9 % à 21,0 % chez les élèves et étudiants. Toutes les tendances étaient statistiquement significatives ($p < 0,0001$). En subdivisant la population des élèves et des étudiants, on a constaté que le taux d'utilisation du casque était de 25 % chez les écoliers du primaire, de 17 % chez les élèves du secondaire et de 20,2 % chez les étudiants du postsecondaire.

Conclusions : L'utilisation du casque de cycliste a augmenté de façon spectaculaire à Ottawa. Notre expérience, de même que le témoignage des autres centres, indiquent que des interventions spécifiques, comme la couverture par les médias, les projets d'achat en nombre dans les écoles et les coupons-rabais, peuvent accélérer le taux d'adoption du casque. Bien que moins de la moitié des cyclistes portent le casque, la tendance s'est considérablement accélérée et l'on s'attend à des gains importants au cours des prochaines années. Néanmoins, la résistance des jeunes adultes et le coût des casques pour les groupes à faible revenu peuvent poser des problèmes. Ces difficultés exigent le perfectionnement des futures stratégies de promotion.

Bicycle helmets can save lives and reduce the incidence of injury. Over 100 cyclists, half under the age of 15 years, die every year in Canada of bicycle-related injuries.[1] An estimated 50 000 bicycle-related visits to emergency departments occur each year.[2] Head injuries account for up to 30% of such visits, 70% of resulting admissions to hospital and 70% to 80% of related deaths and long-term disability.[3-10]

The use of helmets has long been accepted in hockey, football and motorcycling. There is strong evidence to recommend such use in bicycling; this includes improved regulatory standards and the growing number of studies demonstrating the effectiveness of bicycle helmets.[11-15] One trial, a case-control study, suggested that helmets can reduce the risk of head injury by 85%.[15]

Yet until recently few cyclists wore helmets. In a baseline survey conducted in Ottawa in 1988[16] only 10% of cyclists overall and 2% of the student population surveyed were wearing helmets. Those findings were consistent with results from other cities in Canada and the United States.[17-19]

Fortunately the situation is changing. Over the past 3 years helmet promotion has received considerable attention. With a well-developed network of bicycle paths Ottawa has a large, active cycling population. Specific interventions targeted at increasing helmet use have included media coverage, the availability of discount coupons and bulk-buying projects in schools. Local merchants, school boards, parent advisory groups, cycling organizations, the Ottawa-Carleton Safety Council and medical associations have all participated in this community-wide effort to promote helmet use.[20-22]

The purpose of this study was to determine the prevalence rates of helmet use by cyclists in Ottawa in September 1991 and to compare them with the rates in the baseline Ottawa survey in September 1988.

Methods

The features of the original 1988 survey,[16] including the time of year, the time of day, the sampling sites and the bicyclist subgroups, were replicated in this study. However, since helmet use was expected to be more prevalent in 1991 than in 1988 two changes were made to improve the quality of the data. First, a larger sample was used to provide smaller confidence intervals and thus improve the estimates. Second, more sampling sites were included to reduce the risk of sampling bias.

Subjects

A total of 3252 cyclists were observed in 1991, as compared with 1963 cyclists in 1988. The sample was separated into weekday city commuters, weekend recreational cyclists and students. The student population was further separated into elementary, secondary and postsecondary groups. Schools randomly selected from the two boards of education in Ottawa and all three postsecondary institutions formed the sample. As expected the sample of schools differed from that in the 1988 survey.

Data collection

All of the subjects were observed on fair days with no rain in the weather forecast.

Commuting cyclists were observed on weekdays between 4 and 6 pm. Observers were stationed at seven sites along the north, south, east and west exits from the city core to the bicycle paths and the more popular commuting routes.

Recreational cyclists were observed on weekends for 2 hours at six sites on bike paths and parkways throughout the city and surrounding areas. This group of cyclists included all age groups; however, as in the 1988 survey, about 90% were adults. In the 1988 survey the use of helmets by children

had been so uncommon that recreational cyclists had been considered as a single group. This time children and adults were counted separately, the former group referring to any cyclist appearing to be less than 15 years of age. This separation allowed for comparisons with the student population.

In the commuter and recreational cyclist groups our objective was to observe at least 1000 cyclists and to limit each site count to 200 cyclists.

Elementary (primary and intermediate grades) and secondary schools in urban and suburban areas of Ottawa were assigned numbers, and a computer program was used to select a random sample from each level. The selected schools were visited before the survey to ensure that there were indeed cyclists. Four secondary schools and eight elementary schools were excluded, because there were either no bicycles or fewer than 20 (at secondary schools) or 10 (at elementary schools) on the grounds during the site visit. Of the 79 elementary schools and 17 secondary schools 8 and 5 respectively were surveyed. Students were observed as they arrived at school in the morning or as they left in the afternoon. The campuses of the two universities and the community college were observed in the morning before the start of classes from the most likely points of arrival of commuting students. To prevent bias from larger schools maximum samples were set for each site: 50 at the elementary schools, 75 at the secondary schools and 200 at the postsecondary schools.

A number of strategies were implemented to minimize the possibility of double counting. Sampling sites were used only once and for a maximum of 2 hours. The commuters were observed only in the late afternoon, and the sampling sites were 2 to 5 km apart. Furthermore, most of the traffic flow was unidirectional, out of the city core. On only two occasions were two sites sampled simultaneously; the first occasion involved commuters and the second recreational cyclists. In both instances the two sites were at opposite ends of the city. Elementary and secondary school students were observed only in parking areas as they locked or unlocked their bikes. Observers were briefed about the problem of double counting and the importance of adhering to the sampling format. The survey received no publicity while it was being conducted.

Statistical analysis

The sample size was chosen to provide 95% confidence intervals to within 3% of the mean in the three cyclist groups. Simple χ^2 techniques were used to compare the prevalence of helmet use in 1988 and 1991.

Results

Of the 3252 cyclists observed in 1991, 1056 (32.5%) were wearing helmets (Table 1). Helmet use was highest in the commuter group (44.6%) and lowest in the student group (21.0%). The rates of use varied little from site to site in the commuter and recreational groups. The single exception, in the commuter group, was at a busy cross street in a low-income multicultural neighbourhood (35%, which was 9% to 10% lower than the average rate in that group) ($p < 0.01$).

In the student population surveyed the rate was highest among the elementary school students

Table 1: Use of bicycle helmets in Ottawa in September 1991, by type of cyclist

Type of cyclist	No. observed	No. (and %) wearing a helmet	95% confidence interval, %
Commuter	1093	488 (44.6)	41.7–47.5
Recreational	1143	355 (31.1)	28.4–33.8
Adult	1019	307 (30.1)	27.2–32.8
Child	124	48 (38.7)	30.1–47.3
Student	1016	213 (21.0)	18.5–23.5
Total	3252	1056 (32.5)	30.9–34.1

Table 2: Use of bicycle helmets by students in September 1991, by type of student

Type of student	No. observed	No. (and %) wearing a helmet	95% confidence interval, %
Elementary school	336	84 (25.0)	20.4–29.6
Secondary school	259	44 (17.0)	12.4–21.6
Postsecondary school	421	85 (20.2)	16.4–24.0
Total	1016	213 (21.0)	18.5–23.5

(25.0%) (Table 2). The rates varied considerably between the schools: 2% to 68% at the primary schools, where more than 25 cyclists were observed, and 4% to 36% at the high schools, where 50 or more cyclists were observed.

The rates of helmet use in 1991 differed dramatically from the rates in 1988 (Fig. 1). After the samples were standardized for size across the cyclist groups total helmet use was found to have increased, from 10.7% to 32.2%, over the 3-year period ($p < 0.0001$). The highest increase in the rate of helmet use was found among the commuters (from 17.9% in 1988 to 44.6% in 1991); the rate had increased from 14.3% to 31.1% among the recreational cyclists and from 1.9% to 21.0% among the students. The biggest changes in helmet use were noted in the student population. The rate of use increased from 0.8% to 25.0% among the elementary school students, from 1.9% to 17.0% among the secondary school students and from 3.0% to 20.2% among the postsecondary school students. All of the trends were statistically significant ($p < 0.0001$).

Discussion

Two method problems in this survey warrant further attention. First, the sampling of the recreational cyclists was not adequately designed to protect against the possibility of double counting. Because Ottawa has such a well-developed network of bike paths we suspect that this was only a minor problem. If we assume that 10% of the recreational cyclists were double counted, probably a liberal estimate, a sample of 114 fewer cyclists would have altered the confidence intervals only a few points.

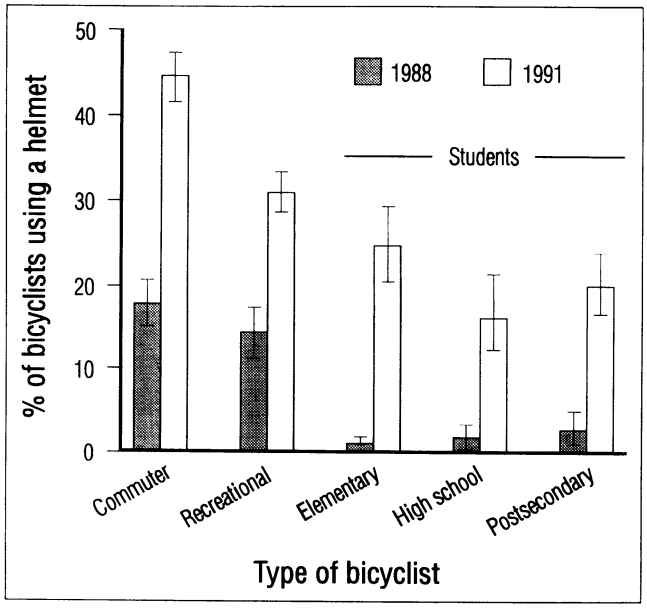

Fig. 1: Rates of helmet use (with 95% confidence intervals) in Ottawa in 1988 and 1991 by type of bicyclist.

Alternatively, if the number of helmets were doubled or halved in 114 (10%) of the recreational cyclists (18 more or 18 fewer helmets) the prevalence rate would have changed from 31.1% to 32.6% or 29.5%, which again is well within the confidence intervals. Consequently, double counting, if it occurred, would probably have altered our results little. In future, however, only unidirectional traffic should be observed as added insurance.

The school sample raised a more important method problem. The eight elementary and four high schools that were excluded for lack of bicycles were predominantly in low-income neighbourhoods. The resulting sample became increasingly biased toward middle-class schools. A few observations may shed some light on what effect this sampling bias had on our data. First, the results from individual schools reflected a strong socioeconomic trend, from 0% helmet use in a school in a high-density public-housing area to 68% use in an upper-income professional neighbourhood. Second, the rate of helmet use was higher among young recreational cyclists than among elementary school students (38.7% v. 25.0%, $p < 0.01$). Given the wide variation in rates in the student population this second observation leads us to believe that the recreational group may more adequately represent helmet use in middle-class and upper-middle-class children in Ottawa. Third, many low-income children do not own bicycles, and the exclusion of certain schools probably reflected this fact. Finally, although it is difficult to assess the impact of sampling bias on our results it is worth remembering that in 1988 only 15 helmets were observed in the entire school sample of 778 students.

The use of bicycle helmets in Ottawa increased dramatically from 1988 to 1991. Close to 50% of commuters are now wearing helmets, as are almost 25% of young cyclists, who account for most of the injured cyclists. The trend is encouraging, and similar progress can be expected over the next few years. Marketing theorists have shown that behavioural innovations start off slowly. More energy and time are often required to convert the first 25% of the population (the "innovators" and the "early adopters") than to convert the middle 50% of the population (the "early" and "late" majority).[23] Our experience, as well as that of others,[18-20,24] indicates that specific intervention can accelerate the rate of helmet adoption. The bicycle helmet trend in Ottawa is clearly in the second stage. Rapid adoption rates will continue until we approach the final 25% of the population (the "late adopters"), who are traditionally the most challenging target group.

Healthy lifestyle innovations involve changes in knowledge, attitude and behaviour. Much has been done in the past 3 to 5 years to call public attention to the dangers associated with cycling and to the

benefits of helmets. What used to be relatively unknown is fast becoming common knowledge.

Work remains to be done to change the attitudes of cyclists, especially those who think that injuries "can't happen to them." Bike injuries are not limited to those with poor cycling skills or to competitive cyclists covering long distances. Bicycle mishaps are common and regularly occur close to home during short rides.[2,5,7,10]

Peer pressure remains an obstacle among secondary and postsecondary school students. Not surprisingly, our data show the lowest rate of helmet use in these groups. Teenagers and young adults are extremely conscious of their appearance and attracted by risk-taking behaviour. Fortunately helmet designs have changed, from the bland, heavy, utilitarian shapes to the light, streamlined, colourful models. Peer pressure may soon become a motivator rather than an obstacle as helmets become an integral part of cycling styles and equipment. Furthermore, rider education and helmet promotion at the primary school level will soon give us a generation of teenagers who will have grown up with helmets, and today's teenagers will become adults who will be more likely to don protective headgear.

A greater long-term challenge is to make helmets affordable for low-income groups. Provincial and federal taxes add roughly 15% to the cost of helmets. Governments must be convinced that tax exemptions for helmets would be cost-effective. Furthermore, production costs must be reduced and effective discount strategies provided for low-income groups.

Such measures will pave the way for eventual mandatory bicycle helmet legislation, already under consideration in Ontario, so that all cyclists can benefit from protective headgear. What was once a distant challenge is fast becoming a reality. Wearing a properly fitted helmet will soon be as normal and essential as having a set of working brakes.

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