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# Predicting and Reinforcing Children's Intentions to Wear Protective Helmets While Bicycling

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**Synopsis**

*The researchers undertook to identify the factors that are most likely to influence children's intentions to use bicycle helmets. To determine the most important intention influencing factors, a random sample of 797 students in grades 4 through 6 completed a self-administered questionnaire concerning their beliefs about helmet use. They were asked about their perceptions of the risk of riding bicycles unprotected, the severity of possible head injuries, and about other bicycle-safety related behaviors.*

*Factors that best predicted the student's intentions to use bicycle helmets involved both behavioral beliefs and normative beliefs. Analysis of factors influencing those with low intentions to use helmets, compared to those with high intentions, suggests the most effective messages that health planners can provide preadolescents to influence them to use helmets. They are that helmet use is fun and attractive, helmets provide a new look and a sporting image, and friends approve of and value this behavior. Parents, and particularly mothers, can reinforce their children's intentions to use helmets and their involvement should be encouraged.*

BICYCLE-RELATED INJURIES are an important health problem among 5- to 14-year-olds (*1-4*), accounting for about 8 percent of all deaths in this age group in the Province of Quebec (*5*).

Head injury is responsible for about 80 percent of deaths from injuries incurred while bicycling (*6, 7*). More than 60 percent of hospitalizations for injuries related to bicycle riding are head injuries (*5, 8*). Helmet use reduces both frequency and severity of head injuries among cyclists (*9-11*). Although the use of bicycle helmets by children can be increased by promotional interventions (*12-16*), the level of helmet use among children is low, varying from 2 to 4 percent of bicycle riders of that age across North America (*17, 18*).

Studies have identified factors linked to use or

*'The least motivated students have the impression that the social group to which they belong disapproves of using a helmet. Those whose intention to use a helmet is strong feel themselves supported by their friends in this decision.'*

nonuse of helmets by young cyclists (*19–23*). Wasserman and coworkers (*23*) suggested that bicycle helmet use was associated with the perception of the risk and severity of injuries incurred in bicycle riding. They found a link between use of bicycle helmets and automobile seatbelts.

Elliot and Shanahan Research (*21*) reported that young people recognized the protective value of helmets and associated helmet use with seatbelt use. It concluded, however, that young persons believe themselves to be at low risk for head injury. The reasons cited for nonuse pertained mainly to normative aspects, such as a perceived disapproval of peers and a fear of looking ridiculous, with the helmet being a symbol of conforming and yielding to pressure from parents. Among all children, those aspects were mentioned more frequently by older boys. Other reasons for nonuse were linked to the helmet itself, which was perceived as making the wearer hot and uncomfortable and as being unattractive and dull in appearance, detrimental to hair styles, difficult to store in school, and easily stolen and damaged.

We sought to define appropriate messages for a proposed bicycle helmet-use promotional campaign among preadolescents. Others have described the need to define a framework for behavior change as a guide to developing and focusing health promotion campaigns on this issue (*24*). We were guided by the theory of reasoned action proposed by Fishbein and Ajzen (*25, 26*). This model has been applied to studies of health behaviors (*27*), exercise-related behaviors such as leisure-time physical activity (*28, 29*), and jogging (*30*), and has been applied to studies of the behavior of young students (*31–33*).

We found the model applicable because of known low use of bicycle helmets among our study population. For example, a telephone survey had reported a regular helmet use rate among children of about 2.4 percent (*5*). A nonrandom observational study of children's bicycle helmet use, performed by police departments in three communities in Quebec in the summer of 1988, showed 3 out of 230 persons younger than 12 years wearing a helmet while bicycle riding, a 1.3 percent observed use rate (*18*).

We decided that analyses based on actual helmet use behavior would not be feasible owing to anticipated low use rates. Thus we selected as dependent variable a factor that could be expected to influence children to adopt the behavior. According to the Fishbein and Ajzen model, behavioral intention to adopt a behavior is a direct predictor of that behavior; the results of several prospective studies supported this interpretation (*29, 32, 34–40*). The model suggests determinants of stated intention. Briefly, behavioral intention is a joint function of behavioral beliefs (beliefs about the outcomes of the behavior), and normative beliefs (perceived approval or disapproval from significant other persons about the behavior) (*25, 26*). Beliefs thus identified could serve as the basis for a campaign aimed at increasing young people's motivation to wear protective helmets while riding bicycles.

External variables were considered, including perceptions of the risk for head injury, perceptions of the severity of head injuries, habitual behaviors related to bicycle safety, the frequency of bicycle use, helmet ownership, and some socio-demographic variables. The decision to include the variables was based on the results of previous studies or because of their predictive value according to other models (*41*). Additionally we sought to identify psychosocial factors likely to influence preadolescents' expressed intentions to use protective bicycle helmets on a regular basis.

## Methodology

The study population was 20,225 students in grades 4 through 6 who were attending 96 French-language, elementary-level schools in the South Shore area of Montreal. In the Quebec school system, such students usually are 8 to 12 years old.

**Sampling procedures.** Sample size determination was based on multiple regression analysis. With $\alpha = 0.01$, $\beta = 0.05$, and at least nine independent variables, a sample size of about 800 was sufficient to detect an $R^2$ as low as 0.05 (*42*). A stratified two-stage cluster sampling strategy was used. The school setting (urban or rural) and the grade level (grades 4 through 6) were the strata. Schools were the elementary sampling unit, and school grades were the secondary unit. We received 947 student

questionnaires and eliminated 150 lacking data, leaving 797 (84 percent) for analysis. No significant differences between respondents and nonrespondents were observed for the socio-demographic and psychosocial variables studied.

**Questionnaire.** The questionnaire was based on information obtained from a preliminary study conducted among a group of 72 students with characteristics similar to the study sample. In the preliminary study, the subjects were asked to complete an open-ended type of questionnaire. Based on the methodology proposed by Ajzen and Fishbein, students were asked to list perceived advantages and disadvantages relating to bicycle helmet use (behavioral beliefs) and to list persons who they thought would agree and those who would disagree with that behavior (normative beliefs).

Based on that information, the most frequently mentioned elements were retained and tested for clarity and simplicity using groups of parents and teachers and a subgroup of other students. The questionnaire was administered during regular classes in May 1989. About 20 minutes was allowed for the students to complete the questionnaire. Students were unavailable for a sample test-retest because of the end of the academic year.

**Variables measured.** The intention to use a helmet was measured for nine circumstances. According to principal component analyses, the four items most related to one's intention to use a helmet were for short trips near the home, to go to the park, to go for a ride, and to go riding with friends. Each item was measured on a 4-point scale: never, 1, occasionally, 2, often, 3, and always, 4. The sum of the scores was the score for intention, ranging from 4 to 16 points. Internal consistency for this construct, calculated by the Cronbach alpha coefficient (*43, 44*), was 0.91.

To measure behavioral beliefs, students were asked to indicate the probability that they would agree with the beliefs, which were three advantages (is fun, makes you look sporty, and makes you feel safe) and five disadvantages (looks ugly, is a bother, looks ridiculous, makes you appear chicken, and makes you likely to be laughed at). The terms are translations of French slang used in the questionnaire. A 5-point scale was used, ranging from not at all, 0, to definitely, 4, for the positive items (advantages) and from not at all, 0, to definitely, minus 4, for the negative items (disadvantages). The sum of the scores from each item gave a score for behavioral beliefs, with a possible range of minus 20 to plus 12. Internal consistency for this construct, calculated by the Cronbach alpha coefficient, was 0.87.

Table 1. Responses to a questionnaire on bicycle riding practices, intention to use a protective helmet, and safety beliefs of 797 preadolescents in Quebec, 1989

| Variables | Mean and SD | Theoretical and observed minimum | Theoretical and observed maximum |
|---|---|---|---|
| Intention | 9.24 ± 4.02 | 4.00 | 16.00 |
| Behavioral beliefs | 0.21 ± 7.88 | −20.00 | 12.00 |
| Normative beliefs | 1.14 ± 2.58 | −6.00 | 6.00 |
| Perception of risk | 3.39 ± 0.80 | 1.00 | 4.00 |
| Perception of severity | 2.72 ± 0.63 | 1.00 | 3.00 |
| Frequency of bicycle use | 3.54 ± 0.68 | 0.00 | 4.00 |
| Stopping at stop signs | 3.34 ± 0.85 | 1.00 | 4.00 |
| Riding with passenger | 1.29 ± 0.55 | 1.00 | 4.00 |
| Riding on sidewalk | 1.99 ± 0.79 | 1.00 | 4.00 |
| Riding with traffic | 3.02 ± 0.99 | 1.00 | 4.00 |

NOTE: SD = standard deviation.

Normative beliefs were measured by asking students to what extent they thought their father, mother, or friends would be supportive of or opposed to the fact that they used a helmet every time they rode a bicycle. A 5-point scale was used for each item, ranging from very much for, 2, to very much against, minus 2. The score for normative beliefs varied from minus 6 to 6. Internal consistency for this construct, calculated by the Cronbach alpha coefficient, was 0.79.

Perception of risk was estimated by asking subjects to evaluate the risk for head injury while bicycling without a helmet. A 4-point scale was used from no risk at all, 1, to very high risk, 4. Perception of the severity of a head injury incurred while bicycling was estimated by asking the students to compare the severity of such an injury to the severity of scraping one's knee. This scale offered three choices, as severe, a little more severe, and a lot more severe.

Habitual bicycle-safety related behaviors were measured according to four reported behaviors defined by the Quebec bicycle road safety code, which is taught to children at the primary level. Safe behaviors are stopping completely at stop signs or red lights and riding in the same direction as the traffic; unsafe behaviors are riding with a passenger and riding on a sidewalk. The internal consistency of these items indicated that each item had to be considered separately. These behaviors were coded from never, 1, to always, 4.

Frequency of bicycle use during the summer was measured categorically: never, 0, less than once a week, 1, between once and twice a week, 2,

Table 2. Correlation matrix of variables in responses to a questionnaire on bicycle riding practices, intention to use a protective helmet, and safety beliefs of 797 preadolescents in Quebec, 1989

| Variable | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| 1. Intention | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| 2. Behavioral beliefs | [1]0.69 | ... | ... | ... | ... | ... | ... | ... | ... |
| 3. Normative beliefs | [1]0.48 | [1]0.49 | ... | ... | ... | ... | ... | ... | ... |
| 4. Perception of risk | [1]0.26 | [1]0.25 | [1]0.21 | ... | ... | ... | ... | ... | ... |
| 5. Perception of severity | 0.03 | 0.05 | 0.02 | 0.10 | ... | ... | ... | ... | ... |
| 6. Frequency of bicycle use | −0.07 | −0.10 | −0.07 | −0.04 | −0.01 | ... | ... | ... | ... |
| 7. Stopping at stop signs | [1]0.27 | [1]0.30 | [1]0.17 | 0.07 | 0.05 | −0.10 | ... | ... | ... |
| 8. Riding with passenger | [1]0.18 | [1]−0.18 | [1]−0.12 | −0.03 | −0.07 | [1]0.12 | [1]−0.28 | ... | ... |
| 9. Riding on sidewalk | [1]−0.12 | [1]−0.11 | −0.06 | −0.04 | −0.01 | 0.04 | [1]−0.14 | [1]−0.16 | ... |
| 10. Riding with traffic | [1]0.18 | [1]0.18 | [1]0.16 | 0.04 | 0.07 | 0.00 | [1]0.31 | [1]−0.18 | −0.05 |

[1] $P < 0.001$.

between three and five times a week, 3, and every day, 4.

Other variables measured were the student's ownership of a helmet, sex, academic level, and school location, such as urban or rural setting.

**Statistical analysis.** Multiple stepwise regression analysis was used to identify the predictors of intention. Inclusion criteria for each predictor were an empirical significance level less than 0.01 ($P < 0.01$) and a standardized partial regression coefficient of 0.15 or more. Subsequently, in order to establish the cognitive differences between those with low intention to use a helmet and those with high intention, discriminant analyses were performed on items of each predictor separately.

## Results

The final sample was 797 students, of whom 32.2 percent were in fourth grade, 31.9 percent in fifth grade, and 35.9 percent in sixth grade. Twenty-seven percent of students were attending school in a rural setting and 73 percent in an urban setting. Fifty-one percent of the respondents were girls.

Among all respondents, 92.6 percent reported riding a bicycle at least three times a week during the summer. Nearly two out of three (62.9 percent) reported riding every day. As for respecting the bicycle road safety code, 81.5 percent of the respondents reported that they stopped at red lights or stop signs and 69.4 percent reported that they rode in the same direction as the traffic often if not always. Riding with a passenger occasionally or more often was reported by 25.3 percent of the respondents. Riding on a sidewalk at least sometimes was reported by 74.0 percent.

The average reported intention to wear a helmet was neutral, a mean of 9.24 ± 4.02 standard deviation (SD) on a scale ranging from 4 to 16. Only 34 students (4.1 percent) reported owning a bicycle helmet; 25 of those helmets were identified as a BMX helmet used in cross-country and trick riding, and 9 (1.1 percent) were of a type likely to be approved for bicycle riding under standards published by the American National Standard Institute or the Snell Memorial Foundation. Table 1 shows the analysis of the questionnaire variables.

Correlations between the variables are shown in table 2. School grade was negatively associated with the intention to use a helmet (Kendall's tau = 0.13, $P < 0.0002$), but sex and school setting were not associated with the dependent variable. Intention was significantly associated with behavioral beliefs ($P < 0.001$), normative beliefs ($P < 0.001$), habitual safety-related behaviors ($P < 0.001$), and perception of risk ($P < 0.001$). Perception of severity was not associated with the dependent variable.

Table 3 shows the multiple regression of the respondents' intention to use a helmet on the variables. Two predictors explained 51 percent ($P < 0.0005$) of the total variance. The behavioral beliefs' construct was the most important predictor, with a standardized partial regression coefficient of 0.57 ($P < 0.0005$). Normative beliefs were the second most important predictor ($\beta = 0.17$, $P < 0.0005$). Frequency of bicycle use, perception of risk and severity, habitual safety-related behaviors, sex, and setting did not play a significant role in the predictive model.

Discriminant analyses performed on the items from each predictor were done separately and are shown in tables 4 and 5. We examined the behavioral beliefs that differentiated those with high intentions from those with low intentions. Their order of importance was (*1*) would be fun, (*2*) would be a bother, (*3*) would look ugly, (*4*) would look ridiculous, (*5*) would look sporty, (*6*) would make the user feel safe, and (*7*) would make the

user appear chicken (table 4). The likelihood that using a protective helmet would probably lead to the user being ridiculed did not discriminate between the two groups.

With respect to normative beliefs, the degree of support from friends was the most discriminant factor, support from the mother coming second (table 5). Perceived support from the father did not differentiate between the two groups. This can be explained by a strong correlation ($r = 0.81$) between the perceived approval of the father and mother, the mother's approval being perceived as slightly more positive among both groups.

## Discussion

We found that intention to use a protective helmet was rather neutral; in general, respondents were neither strongly in favor of or strongly opposed to helmet use. This may be explained by the fact that respondents were unfamiliar with helmet usage.

Two variables proposed by the theory of reasoned action, that is, behavioral beliefs and normatives beliefs, were the best predictors of intention to use a bicycle helmet. The influence of these variables has been observed in studies applied to other health-related behaviors among preadolescents (*33, 41, 42, 45, 46*).

The results of the study are in agreement with those of Chassin and coworkers (*46*) who have shown that behavioral beliefs were better predictors of intention to smoke cigarettes than were normative beliefs. Nonetheless, the additional influence of normative beliefs indicates how support from friends appears as an important factor in young people's decisions. The least motivated students have the impression that the social group to which they belong disapproves of using a helmet. Those whose intention to use a helmet is strong feel themselves supported by their friends in this decision. Peers seem to similarly affect the definition of behavioral beliefs among preadolescents (looking ridiculous, being laughed at) and the normative pressure that they feel. Grube and coworkers (*33*) have underlined the importance of approval from friends among 11- to 14-year-olds regarding their decision to smoke. Godin and Shephard (*47*) observed the same type of influence among seventh to ninth graders concerning physical activity.

The analysis permits an estimation of the relative importance of explanatory factors in the study population. Although significantly associated with intention, perception of risk and habitual safety-related behaviors have not been identified as important predictors of stated intention. This could be partially explained on the basis of problems with measurement. Furthermore, this observation is contrary to the results of Wasserman and coworkers (*23*). They identified belief in the risk of head injury, belief in the seriousness of head injury, and wearing a seatbelt in a car as variables associated with observed bicycle helmet use. However, our study differs from Wasserman's in several aspects. That study predicted an observed behavior, while we measured stated intention, because of the very low helmet use rate in our study population. Their sample was composed of children and adults. They did not study attitudinal and normative factors as extensively as we did, and the variables are not comparable because of the way they were measured.

Table 3. Stepwise multiple regression of responses to a questionnaire on bicycle riding practices, showing predictors of intention to use a protective helmet by 797 preadolescents in Quebec

| Variable | *Unstandardized partial regression coefficient* b ± *SE* (b) | Standardized partial regression coefficient β ± SE (β) | P |
|---|---|---|---|
| Behavioral beliefs .. | 0.29 ± 0.02 | 0.57 ± 0.03 | 0.0005 |
| Normative beliefs... | 0.27 ± 0.04 | 0.17 ± 0.03 | 0.0005 |
| Constant ..... | 6.59 ± 0.61 | ... | 0.0005 |

NOTE: Overall $R^2$ adjusted = 0.51, $f = 408.15$, $P < 0.0001$. SE = standard error.

Table 4. Discriminant analysis of behavioral beliefs that differentiated those with high intentions to wear a helmet and those with low intentions, ranked by order of importance, in response to a questionnaire on bicycle riding beliefs and practices of 797 preadolescents in Quebec, 1989

| *Order of beliefs* | *Low intenders, mean and SD* | *High intenders, mean and SD* | *Standardized discriminant coefficients (P < 0.0005)* |
|---|---|---|---|
| 1. Would be fun[1] ... | 0.97 ± 1.14 | 2.36 ± 1.38 | 0.53 |
| 2. Would be a bother[2]..... | −1.94 ± 1.37 | −0.67 ± 0.88 | 0.35 |
| 3. Would look ugly[2] . | −1.89 ± 1.36 | −0.57 ± 0.97 | 0.28 |
| 4. Would look ridiculous[2]..... | −1.83 ± 1.41 | −0.53 ± 0.94 | 0.23 |
| 5. Would look sporty[1] ..... | 1.84 ± 1.39 | 2.81 ± 1.34 | 0.13 |
| 6. Would make the user feel safe[1] ..... | 2.83 ± 1.24 | 3.44 ± 0.99 | −0.11 |
| 7. Would make the user appear chicken[2]..... | −1.13 ± 1.42 | −0.31 ± 0.82 | −0.11 |

[1] Scale from not at all, 0, to definitely, 4.
[2] Scale from not at all, 0, to definitely, minus 4.
NOTE: SD = standard deviation.

Table 5. Discriminant analysis of normative beliefs that differentiated those with high intentions to wear a helmet and those with low intentions, ranked by order of importance, in response to a questionnaire on bicycle riding beliefs and practices of 797 preadolescents in Quebec, 1989

| Order of beliefs | Low intenders, mean and SD | High intenders, mean and SD | Standardized discriminant coefficients ($P < 0.0005$) |
|---|---|---|---|
| 1. Friends.... | $-0.29 \pm 1.06$ | $0.70 \pm 1.16$ | 0.87 |
| 2. Mother .... | $0.89 \pm 1.07$ | $1.46 \pm 1.00$ | 0.28 |

NOTE: SD = standard deviation. Scale from very much for, 2, to very much against, minus 2.

Practical lessons can be drawn from these results. Behavioral beliefs seem to be the strongest predictors of the expressed intention to use a bicycle helmet. If priorities are to be established, elements from this construct could guide the choice of the initial promotional activities. Specifically, the beliefs that should be chosen are the fun aspects, the esthetics, and the convenience associated with bicycle helmet use. Promotional messages should predominantly suggest the image that helmet use is synonymous with having fun, is attractive and pleasurable, and makes the wearer look sporty.

In order to account for the influence of friends, messages should refer to the image that young people believe they project to others when they are wearing a helmet. Thus, the belief that it gives them a sporty look must be reinforced. Specific steps could be directed toward parents, specifically mothers, so that they clearly understand their reinforcing role in adopting and maintaining bicycle helmet use by their children.

All young persons, whether strongly or weakly motivated to use a bicycle helmet, give a highly positive score to the feeling of safety linked to helmet use. This aspect could be reinforced without making it the main point of a campaign and could present helmet models in different designs and colors. Suggestions for designs could be offered to manufacturers in drawings by children. The product should be readily available at many places and at low cost. It should be shown as comfortable, adjustable, light, easy to store, and convenient to use. Creative solutions should be developed, such as a theft-proof attachment mechanism on the bicycle and specific storage compartments at school and in parks.

The study design permitted us to identify factors related to expressed intention to use a protective bicycle helmet among preadolescents. These results apply only to children ages 8 to 12 years who show the same sociodemographic characteristics as this sample. The same results may not be found among younger or older students, because, for example, adolescents respond to peer pressure even more than preadolescents. Other studies among different samples are necessary to confirm these results.

Our findings have been used in the development of promotional messages for a helmet promotion campaign in the South Shore area of Montreal. Young students seemed to have specific needs and perceptions regarding the use of helmets. Their needs were acknowledged and addressed in a manner to increase their motivation and their preventive behavior. Our further studies are to provide analyses on the basis of stated and observed usage and whether promotional efforts lead to increased usage.

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