Safety

Evaluation of a Community Bicycle Helmet Promotion Campaign: What Works and Why

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Abstract

Purpose. *This study identifies effective components of a bicycle helmet promotion campaign, and mechanisms by which these components affect child helmet ownership.*

Design. *A random telephone survey identified parents whose children did not own helmets prior to an educational campaign. A follow-up survey was conducted six months later. Regression analysis estimated the effects of four campaign components on child helmet ownership and tested for mediation by cognitive variables.*

Setting. *Study participants were residents of a suburban community which undertook a citywide educational campaign to increase child helmet ownership.*

Subjects. *Subjects were 210 parents with at least one school-aged child, none of whom owned helmets.*

Intervention. *A multicomponent campaign was implemented by a community coalition. In addition, random subsamples of the study participants received direct mail or direct telephone communications.*

Results. *Of the eligible respondents identified in the baseline sample, 39% completed the follow-up survey. Regression analysis showed that children whose parents received either helmet advice from a physician or direct telephone communications were 2.6 and 2.2 times more likely, respectively, to own helmets as children whose parents did not experience similar communication. Parental worry mediated the association, but parental beliefs about the effectiveness of helmets did not.*

Conclusions. *Future helmet campaigns should use interpersonal strategies to increase parental worry about their children being involved in a bicycle accident. Generalization of these findings is limited by the high socioeconomic status of the study participants, and by the outcome measure, which is helmet ownership, not helmet use. (Am J Health Promot, 1993; 7(4):281-287)*

Key Words: Bicycle Helmets, Bicycle Injuries, Injury Prevention, Community Intervention

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INTRODUCTION

Unintentional injury is the most frequent cause of death and disability in children[1] and is also among the most preventable. Of the seven leading causes of injury death among children, Hopkins, Writer, Mortensen, and Indian[2] found that estimates of preventable deaths point to a need to place emphasis on reducing motor vehicle accidents, drownings, and injury to bicyclists. In the United States in 1990, 31,000 children under the age of 15 were killed or injured while riding a bicycle.[3] Data from the 1991 annual report of fatal and injury-related motor vehicle and traffic accidents[4] indicate that in California 16,561 cyclists were killed or injured in police-reported accidents. These numbers underestimate the true number of bicycle injuries, since they reflect only those recorded in traffic accident reports.

About half of all bicyclist deaths occur among children age 16 or younger,[5] and most involve head trauma. In addition, a significant proportion of the children who seek medical attention for bicycle-related injuries sustain head and neck injuries.[6] Many of these injuries might have been prevented through the use of bicycle helmets. A number of studies have concluded that the use of bicycle helmets reduces the risk of

head trauma in the event of a bicycle accident.[7-12] A study of 100 head injuries sustained in bicycle accidents concluded that wearing helmets would prevent at least half of minor head injuries, and would reduce the severity of major injuries sustained in bicycle accidents.[8] Thompson, Rivara, and Thompson[9] found that riders with helmets had an 85% reduction in risk of head injury, and an 88% reduction in risk of brain injury compared to riders without helmets. In addition to protecting against skull fractures, helmets also have been demonstrated to reduce the risk of facial injury in the event of a bicycle accident.[10,11] A recent analysis of death certificates and emergency room injury data for the United States[12] concluded that universal use of helmets by all bicyclists could have prevented as many as 2,500 deaths and 757,000 head injuries in a four-year period.

Unfortunately, most children do not wear helmets while riding bicycles.[13] One study found that less than 2% of the children who rode their bikes to elementary school wore helmets.[14] Otis et al. (1992) reported that only 34 out of 797 fourth, fifth, and sixth graders surveyed reported owning a bicycle helmet (4.1%).[15] A Canadian study found that prior to a helmet promotion intervention none of the students riding bicycles to school wore helmets.[16]

Several studies have demonstrated the difficulty of increasing helmet ownership and/or wearing among children through educational efforts alone. A school-based educational program had no effect on the number of children who wore helmets when riding to school.[16] Two studies investigated the effect of physician counseling on helmet purchases for children. The first involved children who were treated in the emergency room for injuries sustained in a bicycle accident.[17] The second involved children who visited a physician for regular ambulatory care.[18] Both studies found no effect of physician counseling on helmet purchases.

In contrast to these education-only interventions, multicomponent studies have been able to increase the use of helmets among children.[19,20] An evaluation of a community-wide campaign to promote helmet use among children demonstrated that the intervention increased helmet use from 4.6% to 14.0% over 16 months.[20] Campaign activities included public service announcements on television and radio, press conferences, print articles, educational pamphlets distributed through physicians' offices, a school-based bicycle safety program, and discount coupons for helmet purchases. A program in Canada compared education alone to education plus a helmet purchase subsidy.[16] The combined intervention increased helmet use from 0% to 22% in one month, whereas education alone had no effect.

It appears that helmet use among school-age children can be increased through community intervention. However, current evidence does not clearly indicate the most parsimonious means for promoting helmet use. Most studies suggest the importance of multicomponent interventions, yet this approach by its very nature obscures an understanding of the most effective mechanism for increasing helmet ownership and use. The issue is further complicated by the necessity for reaching and influencing both parents, who typically purchase the helmet, and children, who then have to decide whether to wear the helmet. In essence, the parent functions as a gatekeeper in this instance, with the ability to supply or deny the child the opportunity to wear a helmet. Thus, an important question concerns how best to approach parents in order to encourage them to purchase helmets for their children.

According to a national survey, parents tend to worry more about kidnapping and drug abuse than childhood injury.[21] These results suggest that parents may not perceive accidents as a threat to their children's safety and, therefore, may not be motivated to take preventive action. Alternatively, the lack of worry may stem from a belief that injuries due to accidents are intrinsically not preventable. Haddon observed in 1964 that "People . . . tend to look upon [injuries] as either punishments or as unwarranted blows delivered by capricious fate."[22] Thus, parents may fail to purchase helmets for a child either because they do not believe that the child is likely to experience an injury from a bicycle accident or because they do not believe that a helmet is an effective preventive measure. Depending on which of these attitudes is more important in determining behavior, helmet promotion interventions should focus either on increasing parents' perceived risk of a bicycle accident or on increasing confidence in the efficacy of helmets.

The present study addresses two questions: 1) Within the context of a multicomponent helmet promotion campaign, which strategies are the most effective? and 2) Do these strategies operate by increasing parental worry or by increasing parental beliefs about helmet efficacy? The results are discussed in terms of their implications for future helmet promotion campaigns.

METHODS

Design

A random telephone survey was conducted just prior to a community-wide helmet promotion campaign. This survey was used to identify parents whose children did not own helmets. A follow-up telephone survey was conducted in November, six months after the campaign kick-off, to assess parents' exposure to campaign information, helmet effectiveness beliefs, level of worry about bicycle accidents, and children's helmet ownership.

Sample

Five hundred and ninety-five parents of children between the ages of five and 18 completed the baseline survey. Respondents were contacted from a list of randomly-generated telephone numbers in Irvine, California, supplied by Survey Sampling, Inc., of Fairfield, Connecticut. Out of the 5,911 numbers called, 1,320 were considered eligible for the survey (i.e., parents of children between the ages of five and 18). Per-

sons who refused to complete the survey or terminated the survey prematurely were considered eligible respondents. All eligible respondents were called at lease five times, and refusals were recontacted at least once. The response rate for the baseline survey was 45%. This percentage is a conservative estimate, since persons refusing to complete the survey were included in the denominator.

Demographic characteristics of the baseline survey participants are presented in Table 1. The majority of respondents were white, female, and reported a household annual income above $50,000. The average age of the sample was 39, and most respondents had at least some college education. Out of the 595 baseline survey participants, 31% reported that at least one of their children owned a bicycle helmet. Out of the total number of children in the sample, however, only 21% (193) owned helmets.

Six months after the baseline survey, a follow-up survey was conducted, in which the 412 parents whose children did not own helmets were recontacted. Fifty-one percent of these parents were successfully reinterviewed. Thus, the sample used in the subsequent analyses and discussion was comprised of 210 parents in Irvine, California, none of whose school-aged children owned helmets at the time of the baseline survey. Demographic characteristics of this sample are presented in Table 1.

Respondents who completed both waves of the survey were compared to the original random sample on demographic factors, including age, sex, ethnicity, income, education, marital status, number of children, and the ages and sexes of children. Students' t-tests revealed that on most demographic features the respondents who were interviewed both times were not significantly different from those interviewed only once, with one exception. Women were significantly more likely to have completed both surveys than were men.

Table 1

Demographic Characteristics of Baseline and Follow-up Survey Participants

	Baseline Survey	Follow-up
Sex		
Male	33%	24%
Female	67%	76%
Age		
Average	39	39
SD	5.9	5
Income		
Less than $25,000	8%	7%
$25-50,000	26%	29%
Over $50,000	59%	64%
Ethnicity		
White	83%	84%
Non-white	17%	16%
Education		
High School Grad or less	11%	11%
Some College	26%	30%
College Grad	38%	35%
Post Graduate	25%	24%
Parents reporting at lease one child with a helmet*	31%	15%
Children owning a helmet**	21%	12%

*This number reflects the percent of families included in the survey in which at least one child owned a helmet.

**This number reflects the percent of children in the survey who owned a helmet out of the total number of children in all the families included in the survey.

Intervention

In May 1990, a coalition of community volunteers began a community-wide campaign to promote the use of bicycle helmets among school-age children. In addition to public service announcements on television and radio, the campaign featured a community rodeo, school-based education, physician education, articles in the print media, and distribution of discount coupons for helmet purchases. In order to adequately test the relative roles of parental worry and beliefs in helmet efficacy, random subsamples of the parents participating in this study also received direct communication either by mail or telephone designed to educate parents as to the risks of bicycle accidents and the effectiveness of bicycle helmets. The following campaign components were investigated in this study:

Bicycle Rodeo. A one-day event advertised throughout the schools and local media, the Irvine Bicycle Rodeo included safety demonstrations, educational activities, and discounted helmet sales. Approximately 162 parents attended the rodeo with their children.

Physician Education. An information packet was sent to all practicing pediatricians in Irvine. Included in the packet were helmet-promoting posters for office display and "prescription pads" for physicians to use in advising parents that their children should wear helmets.

Direct Mail Communication. An illustrated information packet was sent to a random subsample of the study participants. Included in the packet were statements intended to increase parental worry about bicycle accidents and parental belief that helmets are an effective means of reducing risk of head injury. For example, parents were informed that "for children, bicycle accidents are the most common cause of serious injury to the head and neck," and that "in 1988, nearly all (98%) of the 17 bicylists killed in Orange County were not wearing helmets."

Telephone Communication. The same informational statements contained in the direct mail communication were read aloud in the form of a question over the telephone to a random subsample of the study participants. For example, parents were asked whether they knew that in 1988 nearly all (98%) of the 17 bicyclists killed in Orange County were not wearing helmets.

Measurement

The 10- to 15-minute telephone survey administered to parents included questions on worry about bicycle accidents, helmet-related efficacy beliefs, exposure to information about bicycle safety and bicycle helmets, demographic information, and children's helmet ownership. The questions assessing attitudes and beliefs employed the Likert scales. Items assessing helmet ownership

and exposure to information were dichotomous (yes, no).

Exposure to Helmet Information. Four different sources of exposure to helmet information were assessed. Two were assessed by self-report via the telephone survey, and two were experimentally assigned. The self-reported sources were attendance at a community bicycle rodeo and exposure to helmet advice from a physician. Both were measured dichotomously. The other information sources (also scored dichotomously) were direct mail communication and telephone communication. These interventions were experimentally controlled and were administered to random subsamples of the study participants.

Parental Worry About Bike Accidents. Two survey items were averaged to yield a measure of parental worry about children getting into bicycle accidents (Pearson's $r = .96$, $P < .01$). One item was scored on a scale of 1 (never worry) to 10 (constantly worry), and asked how much the respondent worries about their children being injured in a bicycle accident. The second item was scored on a scale of 1 (never) to 4 (often), and asked how often the respondent worries about their child being involved in a bicycle accident.

Parental Helmet Efficacy Beliefs. A single item assessed helmet effectiveness beliefs. Respondents were asked "How effective do you think a helmet is in preventing injury?" Responses were on a scale of 1 (not effective) to 4 (very effective).

Children's Helmet Ownership. For each child in the household between the ages of five and 18, the respondent was asked whether that child owned a bicycle helmet. Responses were dichotomous (1 = no, 2 = yes).

Analyses

This study required two types of analyses: one involved parents only, and the other looked at the parent-child dyad. For those analyses using child helmet ownership as the dependent variable, the unit of analysis was the child-parent pair. Thus, the total sample used for the logistic regression equations described below was 397 (the number of children in the sample). For the analyses using parental worry and/or efficacy as the dependent variable, the unit of analysis was the individual respondent. Thus, the total sample included in the linear regression analyses below was 210 (the number of parents in the sample).

The data analysis plan followed the procedure described by Baron and Kenny[23] to test for a mediating relationship. This method prescribes a series of regression analyses that were carried out for worry and effectiveness beliefs separately; "first, regressing the mediator on the independent variable; second, regressing the dependent variable on the independent variable; and third, regressing the dependent variable on both the independent variable and on the mediator." Baron and Kenny[23] also describe the conditions required to establish mediation: "First, the independent variable must affect the mediator in the first equation; second, the independent variable must be shown to affect the dependent variable in the second equation; and third, the mediator must affect the dependent variable in the third equation. If these conditions hold in the predicted direction, then the effect of the independent variable must be less in the third equation than in the second."

The first step in the current test for mediation was to regress each of the potential mediators (i.e., parental worry and helmet effectiveness beliefs) on the four independent variables being evaluated (i.e., bicycle rodeo, physician, direct mail, telephone communication). The next step was to regress the dependent variable (i.e., child helmet ownership) on the independent variables that emerged as significant predictors of the mediator on the first step. Finally, child helmet ownership was regressed on both the independent variables and the mediator. Logistic regression was used for those equations with helmet ownership as the dichotomous dependent variable.

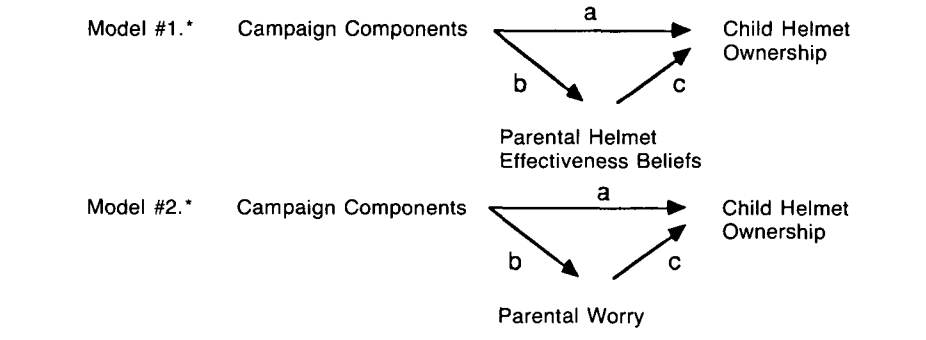
This series of analyses was carried out first with the helmet effectiveness beliefs variable as the potential mediator, and then with parental worry. If at any point in the series of regressions the conditions for mediation were not met, the analysis of that potential mediator was terminated.

RESULTS

Figure 1 illustrates the two models tested. In the first model, parental helmet effectiveness beliefs mediate the association between the effective

Figure 1

Models Tested



* To support the models, pathways a and b should be significant, and pathway a should become insignificant when controlling for c.

campaign components and helmet ownership. In the second model, parental worry mediates the association.

Parental Helmet Effectiveness Beliefs

The majority of parents (61%) believed that helmets were "very effective" in preventing head injury. The mean of the effectiveness variable, which ranged from 1 to 4, was 3.5, with a standard deviation of .69.

The first step of the analysis was to test for an association between the four campaign components and parental helmet effectiveness beliefs. The stepwise procedure was specified in order to identify those components that significantly influenced effectiveness beliefs. The overall model did not significantly predict effectiveness beliefs ($F = 2.05$, $P > .05$). As this result did not meet the criteria for the test of mediation, the analysis of parental effectiveness beliefs as a mechanism for explaining an association between campaign components and helmet ownership was not continued further.

Table 2

Linear Regression Coefficients for Helmet Information Sources Associated with Child Helmet Ownership

Variable	B	SE	P Value
Physician advice	1.30	.23	.000
Telephone message	.67	.17	.000

Multiple R = .32 Adj R^2 = .09
F(2,373) = 9.44 P = .0000

Table 3

Logistic Regression Coefficients and Odds Ratio for Variables Associated with Helmet Ownership

Independent Variables	B	SE	Odds Ratio
Equation #2[a]			
Physician advice	.95*	.46	2.6
Telephone message	.82*	.35	2.2
Equation #3[b]			
Physician advice	- .33	.24	.72
Telephone message	- .33	.18	.72
Worry	.30*	.12	1.30

[a] Model $X^2 = 8.02$; $df = 2$; $P = .018$.
[b] Model $X^2 = 14.132$; $df = 3$; $P = .002$
*$P < .05$

Parental Worry

Responses on the combined variable ranged from 1 to 7, with the higher number corresponding to a greater degree of worry. The mean of the worry variable was 3.8, with a standard deviation of 1.57.

As with the effectiveness variable, the test for mediation by the parental worry variable called for regressing worry on the campaign components using a stepwise procedure. Table 2 presents the results of this analysis. Of the four campaign components, two were significantly associated with parental worry: physician advice ($P < .001$); and telephone communication ($P < .01$). The two variables together explained 9% of the variance in worry (multiple R = .32). Having met this criterion for mediation (i.e., the independent variables were shown to affect the mediator), the test for mediation was continued.

Table 3 presents the results of the second and third steps in the test for mediation by the worry variable. The second step in the test for mediation was to examine the association between the campaign components and child helmet ownership. In the logistic regression equation predicting child helmet ownership from physician advice and telephone communication, both campaign components significantly predicted helmet ownership ($P < .05$). The odds ratio, obtained through the logistic regression procedure, indicated that a child whose parent had received advice from a physician was 2.6 times more likely to own a helmet than a child of a respondent who did not receive advice from a physician. Similarly, a child of a respondent who had received the telephone communication was 2.2 times more likely to own a helmet than a child of a respondent who did not receive the telephone message.

The final step in the test for mediation was to regress the dependent variable (child helmet ownership) on both the mediator (worry) and the independent variables (physician advice and telephone communication). In the resulting logistic regression model equation, parental worry remained a significant predictor of helmet ownership (Wald = 5.77; $P < .05$), but the two campaign components were no longer statistically significant ($P > .05$). These findings support the role of parental worry about bicycle accidents as a mediator in the relationship between the interventions (physician advice and telephone communication) and child helmet ownership.

DISCUSSION

The current findings support previous studies that demonstrate a positive association between multicomponent community helmet promotion programs and helmet ownership among children. In addition, the present study extends earlier research by identifying two specific campaign components that appear to have the greatest influence on child helmet ownership in the context of this community helmet promotion campaign. Receiving advice from a physician and receiving information over the telephone emerged as the two strongest predictors of child helmet ownership. Interestingly, these two types of information sources involve structured one-on-one encounters between the information provider and the parent. Other sources of information investigated in this study (direct mail, bicycle rodeo) were not characterized by a structured person-to-person exchange of information and were not found to be associated with child helmet ownership.

That structured one-on-one interventions greatly increase the effectiveness of community health promotion campaigns has also been shown with respect to cardiovascular disease risk factor reduction.[24] Thus, the present findings may suggest that community helmet promotion campaigns can be made more effective by the addition of interpersonal education efforts. These efforts, however, may not be as effective in the

absence of the more ubiquitous and less focused campaign components (e.g., public service announcements on radio and television). These campaign elements may function as important cues to action that prompt the individual to follow up on a person-to-person recommendation.

The second important finding in this study involves the belief mechanisms that may help to account for the association between parent education and child helmet ownership. Two potential mediators were examined: parental beliefs about the effectiveness of helmets in preventing injury from a bicycle accident, and parental worry about their children getting into a bicycle accident. Only the worry variable emerged as a mediator of the information—helmet ownership association. Thus, this study suggests that increasing parental worry about their children's likelihood of experiencing a bicycle accident is more likely to increase child helmet ownership than teaching parents about how effective helmets can be for preventing head injury.

These findings support the hypothesis that absence of preventive action may be due to a failure to perceive accidents as a threat to health and safety. In fact, the majority of parents did believe that bicycle helmets were "effective" or "very effective" in preventing serious injury in the event of a bicycle accident. Thus, the present data suggest not only that increasing helmet efficacy beliefs is an inefficient strategy for increasing helmet ownership, but also that there may be little need for this type of education. In contrast, many parents did not perceive bicycle accidents as a serious threat to their children's safety, suggesting that increasing parental worry might be accomplished with relatively little effort.

The large majority of the parents in the sample who believed helmets to be effective may not be typical of the general population. It may be, therefore, that increasing worry about bicycle accidents leads to increased helmet ownership among children whose parents already believe that helmets are effective. Parents who worry considerably about bicycle accidents and do not believe that helmets are effective may choose to restrict bicycle riding rather than purchase a helmet. Thus, this study should not be interpreted to mean that providing information about helmet effectiveness is an unnecessary component of a helmet promotion campaign. The lack of an association between effectiveness beliefs and helmet ownership in this sample may be due in part to the relatively high educational level of the study participants. The effectiveness of campaigns implemented among populations with less education may revolve equally around increasing both worry and helmet effectiveness beliefs. Efforts to test for an interaction between worry and effectiveness beliefs were constrained in this study by the lack of sufficient variability in the effectveness variable (i.e., most respondents believed that helmets are effective in preventing injuries due to bicycle accidents); a situation that may also have contributed to the absence of an association between information and efficacy. Future studies will require a more sensitive measure of effectiveness so as to permit investigation of the potential interaction.

The design of the present study precludes a conclusion that exposing parents to interpersonal communication increases worry. Because worry was measured only in the follow-up survey, it cannot be demonstrated that parental worry increased following the helmet campaign. It could be that already worried parents who believe helmets are effective are more likely to buy helmets when cued by a physician or telephone call. In order to clear up this issue, future studies should measure the cognitive variables both before and after an educational intervention. Such a design would allow for a rigorous analysis both of the potential effect of worry on attention to injury prevention information and of the proposed role of worry as a mediator in the information-action association.

It is unclear what effect it may have on the findings that the majority of the study participants were female. Whether mothers have more or less influence on child helmet ownership or consistently different levels of worry than do fathers is unknown. This issue does point out that, whereas children are usually influenced by two parents, the present study only obtained cognitive measures from one parent per household. It might be supposed that an even stronger association between parental beliefs and child helmet ownership would be found if both parents' beliefs were included in the analysis.

Finally, it should be noted that the outcome variable in this study was helmet ownership, not helmet use. Whereas other studies have used observational methods to determine rates of helmet use among children,[20] the current investigation relied on parental report. It does not seem likely that parents would be able to give an accurate report of the frequency with which their children actually wear the helmets. In contrast, parents can be expected to accurately report whether or not their children own helmets. Further, helmet ownership acts as a crucial predisposing condition required for a child to have the opportunity to wear a helmet. Thus, it seems appropriate to address the problem of promoting child helmet ownership as a means of increasing child helmet wearing.

Future research in this area should examine other potential mechanisms by which exposure to information leads to helmet ownership. Other possible mediators include perceived ease of helmet use, perceived access to helmets, perceived social norms, and social regulation (e.g., peer pressure). In addition, future studies should attempt to assess these variables at the level of the child, as well as at the level of the parent. Increasing helmet usage depends on understanding the processes by which parents take action to provide their children with helmets as well as the processes by which children decide to use them. The present study addresses the first issue, and it is hoped that future studies will be able to build on these findings to further understand both processes.

SO WHAT? Implications for Health Promotion Practitioners and Researchers

This study suggests that children's bicycle helmet ownership can be increased by educating parents about the risks of bicycle riding. If the results hold true, practitioners should use interpersonal strategies to persuade parents to worry about bicycle accidents. Implications for researchers include the need to examine worry as a cognitive mechanism that may explain the effectiveness of some educational programs in the community.

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