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Testing the Health Belief Model in a Field Study to Promote Bicycle Safety Helmets

Calls for communitywide interventions to promote bicycle safety helmet usage among children abound, yet little is known about the factors that cause parents to purchase helmets and consistently insist on their usage. The health belief model proposes that cues to action are important influences on self-protective behaviors. A communitywide field study was conducted to test the effectiveness of six different kinds of cues to action. Parents of children between the ages of 5 and 18 were selected via random-digit-dialing techniques for participation in the study. The results indicated that cues to action affected perceptions of threat but were unrelated to attitudes, intentions, or behaviors. However, perceptions of threat were found to be important influences on bicycle helmet attitudes, intentions, and behaviors.

Bicycling accidents are a significant cause of injury and death for children and young adults (e.g., Armson & Pollard, 1986; Friede, Azzara, Gallagher, & Guyer, 1985; Krause, Fife, & Conroy, 1987; Lapner & Leslie, 1981; Reynolds & Cohen, 1987). Recent studies have shown that thousands of deaths can be prevented (Sacks, Holmgreen, Smith, & Sosin, 1991) and the risk of head injury can be reduced substantially (Thompson, Rivara, & Thompson, 1989; Worrell, 1987), if bicycle safety helmets are used consistently (cf. Thompson, Thompson, Rivara, & Wolf, 1990).

Interventions designed to promote bicycle helmet usage have met with limited success. For example, communitywide campaigns with mass media components yielded increases in helmet ownership, but physician recommen-

dations failed to affect helmet purchasing (Cushman, James, & Waclawik, 1991). Although calls for multidisciplinary interventions promoting safety helmet usage abound (e.g., Cushman, Down, MacMillan, & Waclawik, 1991; Runyan & Runyan, 1991), little has been done to assess the specific factors that influence individuals to first purchase and then consistently use bicycle safety helmets. The present work is a first attempt to isolate these factors.

The health belief model (HBM; see Figure 1) (Janz & Becker, 1984; Maiman & Becker, 1974; Rosenstock, 1974) was used as a guide to evaluate the decision-making factors contributing to the adoption and consistent use of bicycle safety helmets. According to the HBM, preventive behaviors are influenced by five factors: (a) perceived barriers to performing the recommended response (e.g., beliefs about psychological, physical, or financial "costs"), (b) perceived benefits of performing the recommended response (e.g., expectations about injury prevention, reduction of anxiety), (c) susceptibility (e.g., subjective probability of experiencing a hazard), (d) perceived severity (e.g., beliefs about the seriousness of the hazard), and (e) cues to action (e.g., advertisements). The "combined levels of susceptibility and severity" are said to provide "the energy or force to act and the perception of benefits (less barriers)" are said to provide "a preferred path of action" (Rosenstock, 1974, p. 332)

Cues to action are thought to be necessary to stimulate decision-making processes leading to self-protective behaviors. Cues to action can occur internally, as when a persistent cough motivates one to quit smoking, or externally, as when mass media messages highlight the hazards of smoking cigarettes. "Unfortunately, few HBM studies have attempted to assess the contribution of 'cues' to predicting health actions" (Janz & Becker, 1984, p. 3). Cues to action (e.g., physician recommendations, television commercials) are of special interest to bicycle injury control specialists in that these are the variables that presumably trigger safety helmet purchasing and usage patterns. Because of the proposed importance of cues to action and because of the relative empirical neglect of the construct, the goal of the present work is to assess the impact of cues to action on bicycle helmet safety practices.

Theoretically, the HBM proposes that cues such as mass media campaigns increase perceptions of threat, which then should increase helmet usage (see Figure 1). Therefore, cues do not directly elicit self-protective behaviors. Rather, cues make one feel threatened by the given hazard or disease (in this case, bicycling injuries) and then these perceptions of threat should motivate protective behavior responses (the use of safety helmets). Thus, according to the HBM, cues indirectly influence behaviors, as mediated by perceived threat. Previous bicycle helmet interventions have examined the effect of

Figure 1: Basic elements of the health belief model. (Becker et al. 1977; reproduced with permission of J. B. Lippincott Company).

cues on behaviors directly, with disappointing results. For example, Cushman et al. (1991) reported that physician counseling (a cue) had no effect on bicycle helmet purchasing. According to the HBM, however, a cue such as physician counseling would not be expected to have a direct effect on helmet-purchasing behaviors. Rather, physician counseling should first increase perceptions of threat, which then may impact helmet usage or purchasing. Perceptions of threat may have influenced helmet purchasing in Cushman et al. (1991), in which bicycling accidents were reported to be significantly related to helmet purchasing. Interpreted within the HBM framework, the bicycling accident may have served as a cue, which affected perceptions of threat (increased susceptibility), and then resulted in bicycle helmet purchases (see also, Fullerton & Becker, 1991).

In short, cues are believed to be important, but little studied, influences on an individual's decision to adopt a preventive behavior (Janz & Becker, 1984). The goal of the present work is to study perceived threat and cues to action as they relate to elements of the HBM and bicycle safety helmet practices. Benefits and barriers were not examined in this study because our primary variable of interest was cues to action, which is unrelated to benefits and barriers. Therefore, the bottom portion of the diagrammatic representation of the HBM (Figure 1) served as the guide for the study. It should be noted, however, that our approach is limited in that we tested only portions of the HBM. More recent research has focused on the interdependency of the components of the HBM (e.g., Aspinwall, Kemeny, Taylor, Schneider, & Dudley, 1991).

First, the nature of perceived threat was investigated. A core assumption of the HBM is that perceptions of susceptibility (e.g., "I'm at-risk for being injured in bicycling accidents") and perceptions of severity (e.g., "Serious and sometimes fatal injuries stem from bicycling accidents") underlie the construct perceived threat (see Figure 1). However, most HBM research has failed to address the composition of the perceived threat variable and analyzed only the separate influences of perceived severity and perceived susceptibility on likelihood to take action (e.g., Aspinwall et al., 1991; Grodner, 1991; Janz & Becker, 1984; Kirscht & Joseph, 1989; Kelly, Mamon, & Scott, 1987; Manning, Barenberg, Gallese, & Rice, 1989). The following hypothesis determines the validity of the HBM's assumption that perceived susceptibility and perceived severity combine to create the perceived threat construct.

Hypothesis 1: Perceived susceptibility to bicycle injury and perceived severity of bicycle injury compose the single dimension of perceived threat.

Second, the influence of various cues to action on perceived threat was explored.

Hypothesis 2: Cues to action (e.g., direct mail, physicians, mass media) will increase perceptions of threat about bicycling injuries.

Third, the effect of perceived threat on acceptance of the recommended responses was examined. The HBM proposes that increased perceptions of threat result in increased adoption of the recommended response.

Hypothesis 3: The greater the perception of threat of bicycle injury, the more favorable the attitudes toward safety helmets, the stronger the intentions to purchase helmets, the greater the likelihood of helmet ownership, and the greater the likelihood of helmet usage.

Fourth, the HBM suggests that cues to action do not directly influence preventive behaviors. Rather, perceived threat is said to mediate the relationship between cues to action and message acceptance. For example, physician counseling about the seriousness of injuries to children from bicycling accidents (a cue) should increase perceptions of threat about bicycling accidents. In turn, stronger beliefs about the threat of bicycling accidents to one's child should motivate parents to purchase and encourage the usage of bicycle safety helmets. In path-analytic terms, we would expect the following relationship: cues → perceived threat → likelihood of taking recommended action.

Hypothesis 4: Cues to action will indirectly influence attitudes toward safety helmets, intentions to purchase safety helmets, safety helmet ownership, and safety helmet usage, as mediated by perceived threat.

Cues were examined for their motivational potential individually (e.g., phone message alone, the community event alone), and then for their combined and cumulative effect.

Methods

Overview

A pretest/posttest study design was employed to test the effectiveness of six different kinds of cues to action on perceived threat and bicycle helmet purchasing and usage practices. The specific goal of the study was to decrease

deaths and injuries among children in a community by convincing parents to purchase safety helmets and promote their usage. Parents of children between the ages of 5 and 18 from southern Orange County, California, cities (primarily Irvine and Mission Viejo) were selected via random-digit-dialing techniques for telephone interviews at Time 1. The cues to action interventions began immediately following the completion of Time 1 telephone interviews. Approximately 4 months later, respondents were reinterviewed over the telephone to assess the effectiveness of the cues to action on perceived threat and bicycle helmet purchasing and usage habits at Time 2.

Sample

Demographic characteristics for the random community sample at Time 1 and Time 2 are compared in Table 1. Attrition from Time 1 to Time 2 appeared to be random except that women and Anglos were significantly more likely to have completed both surveys than were men ($\chi^2 = 16.21, p < .01$) and non-Anglos ($\chi^2 = 11.02, p < .01$). The primary dependent variables pertained to helmet ownership and usage for each child. Thus each child-parent pair served as the unit of analysis in this study (Time 1, $N = 718$; Time 2, $N = 497$). Because helmet purchasing and wearing differed according to each child's age and gender (e.g., parents appeared to buy helmets more readily for boys than for girls; Schneider, 1991), it would have been inappropriate to have grouped separate children into a single family unit.

Interviews

The survey, administered by trained telephone interviewers, lasted 15-30 min. Respondents were told that their telephone numbers were randomly selected and that their responses to the survey would be useful in planning bicycling safety programs for children. The questions were in 4-point Likert-type formats, unless noted otherwise. First, bicycling-related behaviors were solicited for each child with single-item measures (e.g., "Approximately how often does your [youngest] child ride his/her bicycle?" Possible answers ranged from *daily* to *never*). Second, perceived susceptibility (e.g., "How often do you worry about your child being involved in a bicycle accident?" Possible answers ranged from *often* to *never*) and perceived severity were assessed with two items each (e.g., "Do you believe that most head injuries resulting from bicycle accidents are . . ." Possible answers ranged from *very serious* to *not serious*). A perceived threat variable was created by combining the perceived susceptibility and perceived severity items ($\alpha = .61$). Third, the

Table 1
Demographic Profiles of Subjects at Time 1 and Time 2

Characteristic	Time 1 interview ^a % of total	Time 2 interview ^b % of total
Gender		
Male	33	25
Female	67.5	75 ^c
Not ascertained	0.5	0
Education		
High school or GED	11	10
Some college or technical school	27	27
College graduate	37	34
Postgraduate degree	24	26
Not ascertained	0.8	0.6
Income		
\$20,000 or less	4	4
\$20-\$25,000	3	2
\$25-\$35,000	7	7
\$35-\$50,000	16	18
Over \$50,000	59	62
Not ascertained	10	6
Ethnicity		
Anglo	75	80 ^c
Asian	13	10
Hispanic	7	6
African-American	2	2
Other	3	1
Marital status		
Married	83	83
Divorced	12	12
Other	5	4

a. $N = 595$ parents, 718 children.

b. $N = 326$ parents, 497 children.

c. These demographic characteristics were significantly different at Time 2 when compared to Time 1, according to χ^2 tests or Student's t tests (where appropriate) at the .05 level.

dependent variables of attitudes (e.g., measured with three items, "I would support a city law that required children under 18 to wear a helmet." Possible answers ranged from *strongly disagree* to *strongly agree*, $\alpha = .81$), intentions (e.g., "Do you intend to purchase a bike helmet for any of your children in the next six months?"), and behaviors (e.g., "Does your [youngest] child own a bicycle helmet?" Possible answers were yes, no, or "don't know." "Does your [youngest] child wear a helmet most of the time when he/she rides a bike?" Possible answers were yes, no, or "don't know.") were determined. Finally,

exposure to various cues was measured (e.g., "Has a doctor ever advised you to encourage your child to wear a bicycle helmet?"; "Do you recall seeing any information from a newspaper about bicycle safety or helmets?" Respondents chose between yes and no on these items).

Cues to Action

A total of six cues to action were developed for the study. Three of the cues to action were targeted to the community as a whole (i.e., special community event, public service announcements, physician counseling), and the other three cues (i.e., direct mailings, telephone calls, helmet coupons) were administered experimentally to randomly assigned individuals.

Communitywide Interventions

All subjects had the opportunity to be exposed to the three communitywide interventions. Exposure to the three communitywide interventions was measured on the Time 2 interview (e.g., "Have you or any of your children attended any bicycle rodeos held in Orange County in the last 6 months?").

SPECIAL COMMUNITY EVENT

A one-day special event called the Bicycle Rodeo was conducted and organized by community groups at which presentations, special events and activities, and numerous bicycle safety demonstrations were given. This intervention targeted younger preteen bicycle riders, most of whom were escorted by their parents.

MASS MEDIA PUBLIC SERVICE ANNOUNCEMENTS

The city of Irvine produced five bicycling injury prevention and safety-related public-service announcements for radio broadcast. In addition to the public service announcements, special newspaper articles discussing bicycling safety were published (approximately one article per week for 6 months).

PHYSICIAN COUNSELING

All of the pediatricians and family physicians practicing in the city of Irvine, California, were personally contacted by volunteers who discussed with physicians ($N = 56$) the importance of prescribing bicycle helmets to the

parents of children who rode bicycles. In addition, physicians were provided with posters for office display and specially printed prescription pads that promoted the purchase and use of safety helmets for children.

Experimental Interventions

Respondents were randomly assigned either to one of the experimentally administered cues to action (i.e., direct mailing, telephone message, or coupons) or to the control group. The final sample sizes for these groups varied substantially, because of address changes, telephone changes, and refusals, resulting in the following groups: (a) subjects receiving a direct mail message ($N = 179$), (b) subjects receiving a telephone message ($N = 82$), (c) subjects receiving two discount coupons ($N = 90$), and (d) the community control (subjects not exposed to any of the experimental cues) ($N = 137$). The regression approach to analysis of covariance was used to correct for the unequal cell sizes. In this approach, "each cell mean is given equal weight regardless of its sample size" (Tabachnick & Fidell, 1989, p. 340).

DIRECT MAIL COMMUNICATIONS

Threatening messages were developed to directly increase perceptions of susceptibility and perceptions of severity (e.g., "Over two-thirds (70%) of the bicyclists injured in California were children in the age range of 5-14 years old," "98% of the bicyclists killed in Orange County, California, were not wearing helmets," "Head injuries are the major cause of nearly all (85%) bicycling-related deaths") and were directly mailed to individuals' homes. Examples of the mail out are available from the authors upon request.

PHONE MESSAGE (INTERPERSONAL INTERACTION)

The same threatening message facts contained in the direct mail communication were read aloud in the form of questions over the telephone. For example, respondents in this condition were asked whether they knew that, in 1988, 98% of the bicyclists killed in Orange County were not wearing helmets.

SAFETY HELMET COUPONS

Two bicycle helmet coupons redeemable for \$10 off the purchase price were provided by Bell Helmets, Inc., for distribution through the mail.

Results

Hypothesis 1: Perceived susceptibility to bicycle injury and perceived severity of bicycle injury compose the single dimension of perceived threat.

Hypothesis 1 was supported. Confirmatory factor analysis using maximum-likelihood estimation procedures was used to evaluate the fit of the perceived susceptibility and perceived severity items into one threat factor. A single factor solution was produced indicating that perceived susceptibility and perceived severity underlie the single dimension of threat. All factor loadings acceptably exceeded .30 (Kim & Mueller, 1978; Tabachnick & Fidell, 1989). The perceived severity items had factor loadings of .74 and .52, and the perceived susceptibility items had factor loadings of .37 and .35. The chi-square indicated a good fit between the predicted single factor and the observed data ($\chi^2[2, N = 488] = 5.55, p > .05$). The residual matrix was excellent, with no residuals greater than .05. The eigenvalue for the single factor solution was 1.74, explaining 43.4% of the variance.

Hypothesis 2: Cues to action (e.g., direct mail, physicians, mass media) will increase perceptions of threat about bicycling injuries.

In general, hypothesis 2 was supported. Significant main effects for five of the six cues to action emerged, with helmet ownership at Time 1, respondent's gender, and income acting as covariates. The community event, mass media announcements, physician counseling, and telephone message, all significantly influenced perceptions of threat. Respondents exposed to each of these cues had greater perceptions of threat than respondents not exposed to these cues. In contrast, those not receiving a coupon had greater perceptions of threat than those receiving a coupon. Only the mailed message alone failed to affect perceptions of threat ($F[1, 474] = .967, ns$), even though power was high at .99 for a small effect size ($d = .20$) (Cohen, 1988; Kraemer & Thieman, 1987).

First, a significant main effect for the community event was detected, $F[1, 477] = 4.28, p < .05, \eta^2 = .01$. Those attending the rodeo had significantly greater perceptions of threat (adjusted $M = 2.97$) than did those who did not attend the rodeo (adjusted $M = 2.73$). Second, a significant main effect for the mass media announcements was obtained, $F(1, 478) = 12.00, p < .001, \eta^2 = .03$. Those reporting exposure to the mass media public service announcements had greater perceptions of threat (adjusted $M = 2.82$) than did those

who said they did not see the public service announcements (adjusted $M = 2.63$). Third, a significant main effect for physician counseling was found, $F(1, 478) = 17.03, p < .0001, \eta^2 = .03$. Those being counseled by a physician had significantly greater perceptions of threat (adjusted $M = 3.00$) than did those not being counseled by a physician (adjusted $M = 2.68$). Fourth, a significant main effect for the telephone message was detected, $F(1, 478) = 4.44, p < .05, \eta^2 = .02$. Those getting a telephone call had significantly greater perceptions of threat (adjusted $M = 2.85$) than those not getting a telephone call (adjusted $M = 2.70$). Finally, a significant main effect for the helmet coupon was found, $F(1, 478) = 4.59, p < .05, \eta^2 = .01$. Those not receiving a coupon had greater perceptions of threat (adjusted $M = 2.78$) than those who received a coupon (adjusted $M = 2.66$). A one-way analysis of variance indicated a cumulative effect for the number of different types of cues to action on perceived threat such that the more interventions one was exposed to, the greater the perceptions of threat, $F[4, 484] = 5.63, p .001, \eta^2 = .04$ (see Table 2).

Hypothesis 3: The greater the perception of threat of bicycle injury, the more favorable the attitudes toward safety helmets, the stronger intentions to purchase helmets, the greater the likelihood of helmet ownership, and the greater the likelihood of helmet usage.

Hypothesis 3 was supported. Perceived threat significantly and positively influenced bicycle helmet attitudes, intentions, and behaviors. Regression analyses revealed that the greater the perception of threat, the more favorable the attitudes toward bicycle safety helmets ($B = .34, \beta = .31, p < .00001, R^2 = .09$). Similarly, the logistic regressions reported in Table 3 indicate that perceived threat significantly influenced helmet intentions, ownership, and usage. Specifically, as perceived threat increased one unit, parents were 1.69 times more likely to intend to buy their child a safety helmet. Likewise, as perceived threat increased one unit, parents were 1.75 times more likely to have bought their child a helmet, and 1.85 times more likely to report that their child used the helmet most of the time.

Hypothesis 4: Cues to action will indirectly influence attitudes toward safety helmets, intentions to purchase safety helmets, safety helmet ownership, and safety helmet usage, as mediated by perceived threat.

To test the path models proposed in Hypothesis 4 (i.e., cues to action $\rightarrow$ perceived threat $\rightarrow$ attitudes, intentions, or behaviors), the procedures for testing mediational relationships outlined by Baron and Kenny (1986; also,

Table 2

Cumulative Effect of Numbers of Different Cues to Action on Perceived Threat

Number of unique cues	Perceived threat mean ^a
No cues	2.55 _a (0.52)
1 cue	2.68 _{a,b} (0.63)
2 cues	2.80 _{b,c} (0.55)
3 cues	2.91 _c (0.62)
4 cues	2.96 _c (0.45)

Note. Perceived threat was measured on a 4-point scale. Means sharing subscripts are not significantly different at the .05 level.

a. Standard deviations are in parentheses.

Table 3

Logistic Regressions Testing Influence of Perceived Threat on Intentions and Behaviors

Criterion	Predictor variable	Estimated coefficient ^a	Estimated odds ratio	Wald test
Model 1: intentions to buy a helmet	Perceived threat	.53 (0.15)	1.69	12.82*
Model 2: helmet ownership	Perceived threat	.56 (0.15)	1.75	13.33*
Model 3: helmet usage	Perceived threat	.61 (0.17)	1.85	13.47*

Note. Model 1 tested the influence of perceived threat on intentions to buy a helmet in the next 6 months (yes/no), Model 2 tested the influence of perceived threat on helmet ownership (yes/no), and Model 3 tested the influence of perceived threat on helmet usage most of the time (yes/no).

a. Standard errors are in parentheses.

* $p < .001$.

Judd & Kenny, 1981) were used. According to Kenny and colleagues (Baron & Kenny, 1986; Judd & Kenny, 1981), if perceived threat mediates the relationship between cues to action and outcomes, then (a) cues to action should significantly predict perceived threat (Regression 1), (b) cues to action should significantly predict the outcomes (Regression 2), and (c) when both cues to action and perceived threat are entered into the equation (Regression 3), the impact of cues to action on the outcomes should disappear, or at least drop, when compared to the second regression. Perfect mediation would exist if the impact of cues to action on outcomes dropped to zero while controlling for

perceived threat. However, Baron and Kenny (1986) note that "a more realistic goal may be to seek mediators that significantly decrease Path *c* [i.e., cues to action → outcome] rather than eliminating the relation between the independent and dependent variables altogether" (p. 1176).

For uniformity and ease of interpretation, multiple regression techniques were used for all of the mediational analyses, even when the dependent variable was dichotomous. For large samples with relatively even splits between the dichotomous dependent variables (no more extreme than 25%/75%), logistic regression and multiple regression solutions are very close (Tabachnick & Fidell, 1989, p. 271). For the three dichotomous dependent variables, the no/yes splits were 64%/36% for intentions, 67%/33% for helmet ownership, and 75%/25% for helmet usage.

Table 4 shows the results of regressions testing for mediational effects in the manner outlined by Baron and Kenny (1986). The unstandardized regression coefficient (*B*) with its standard error is reported, as well as the squared semipartial correlation, which indicates the unique proportion of variance explained by a specific independent variable (sr^2 can be thought of as the R^2 change for each variable). Helmet ownership at Time 1, education level, income, and respondent's gender were controlled for in all of the regression equations (data on covariate effects are available from authors upon request). Power to detect a moderately small effect size ($r = .20$) exceeded .99, and power to detect a small effect size ($r = .10$) was approximately .60 (Cohen, 1988).

The mediational role of perceived threat was analyzed separately for each cue. For example, to determine whether the community event (a cue) was indirectly related to attitudes, as mediated by perceived threat, one would examine the results of the three regressions in Table 4 under the Community Event and Attitudes headings. If perceived threat acts as a mediator between a cue (e.g., community event, mass media announcements, physician counseling) and an outcome (i.e., attitudes, intentions, ownership, and usage), the first regression should yield significant results, the second regression should yield significant results, and the third regression, with both the cue and perceived threat entered simultaneously, should reveal significant effects for threat alone and no effect for the cue. As can be seen by examining the community event cue, there appears to be no mediation between perceived threat and attitudes, intentions, helmet ownership, or helmet usage. The community event significantly predicts perceived threat, and perceived threat significantly predicts each outcome. However, the community event fails to predict any of the outcomes—either directly or indirectly.

The results pattern for the community event cue is relatively similar to the results patterns for the other cues to action. Table 4 indicates virtually a complete lack of mediation by perceived threat between any of the cues and outcomes. Perceived threat acted as a mediator in only one case (between physician counseling and attitudes). Therefore, Hypothesis 4 was not supported. Cues consistently and systematically predicted perceived threat (except for the direct mail message), and perceived threat consistently and systematically predicted attitudes, intentions, helmet ownership (with two exceptions), and helmet usage (with one exception). Cues did influence intentions directly for three of the cues (i.e., mass media announcements, direct mail message, safety helmet coupon). In addition, the cumulative effect of the cues directly and independently influenced intentions.

Discussion

Results for three of the four hypotheses offered confirmation for the HBM. First, as diagramed by the model, perceived susceptibility and perceived severity were found to compose the single-dimension construct of perceived threat (Hypothesis 1). Second, five of the six cues to action significantly influenced perceptions of threat (Hypothesis 2). And third, perceived threat consistently predicted bicycle helmet attitudes, intentions, and behaviors (Hypothesis 3). Cues to action were neither directly nor indirectly related to attitudes, intentions, or behaviors (Hypothesis 4). There was no evidence that perceived threat acts as a mediator between cues to action and the likelihood of taking the recommended action.

Several interesting patterns with regard to perceived threat and cues did emerge. Four of the individual cues significantly increased perceptions of threat. Individuals exposed to each of the communitywide cues (i.e., the community event, mass media announcements, and physician counseling) and the telephone message perceived bicycling injuries to be more serious and more likely to occur to their children than did those individuals not exposed to the community interventions. This finding demonstrates that community-level campaigns designed to increase awareness and relevance of health-related issues can be successful. Cues also were shown to have a cumulative effect on perceptions of threat, so that the more *different* cues to action an individual was exposed to, the greater perceptions of threat he or she had. This finding suggests that the number of different cues in a community health campaign might be as important as the frequency of being exposed to each cue.

Table 4

Path Analyses Testing for the Indirect Relationship Between Cues to Action and Attitudes, Intentions, and Behaviors, as Mediated by Perceived Threat

Cues to action	Attitudes			Intentions			Behaviors		
	B (SE B)		sr ²	B (SE B)		sr ²	Ownership		Usage
	B	(SE B)	sr ²	B	(SE B)	sr ²	B	(SE B)	sr ²
Community event									
Cue → Threat ^a	.23	(.11)	.008*	.23	(.11)	.008*	.23	(.11)	.008*
Cue → DV ^b	-.04	(.13)	.0004	.17	(.10)	.006	-.01	(.07)	.00003
Cue $\rightarrow$ DV ^c	-.14	(.13)	.003	.14	(.10)	.004	-.02	(.07)	.0001
Threat $\rightarrow$ DV ^c	.38	(.05)	.102***	.14	(.04)	.023***	.05	(.03)	.004 _m
Mass media announcements									
Cue → Threat	.16	(.05)	.019**	.16	(.05)	.019**	.16	(.05)	.019**
Cue → DV	.10	(.06)	.005	.15	(.05)	.023**	-.006	(.03)	.00005
Cue $\rightarrow$ DV	.04	(.06)	.0009	.13	(.05)	.017**	-.01	(.03)	.0004
Threat $\rightarrow$ DV	.37	(.05)	.096***	.13	(.04)	.019**	.05	(.03)	.004 _m
Physician counseling									
Cue → Threat	.26	(.06)	.029***	.26	(.06)	.029***	.26	(.06)	.029***
Cue → DV	.15	(.08)	.008*	.09	(.06)	.005	.01	(.04)	.00008
Cue $\rightarrow$ DV	.06	(.07)	.0009	.05	(.06)	.002	-.003	(.04)	.000009
Threat $\rightarrow$ DV	.37	(.05)	.096***	.14	(.04)	.023***	.05	(.03)	.004 _m
Phone message									
Cue → Threat	.13	(.06)	.01*	.13	(.06)	.01*	.13	(.06)	.01*
Cue → DV	.09	(.06)	.004	-.03	(.05)	.0009	.04	(.03)	.002
Cue $\rightarrow$ DV	.03	(.06)	.0004	-.04	(.05)	.003	.04	(.03)	.002
Threat $\rightarrow$ DV	.38	(.05)	.096***	.15	(.04)	.029***	.05	(.03)	.004
							.05	(.03)	.005 _m

Direct mail message

Cue → Threat	-.05	(.05)	.002	-.05	(.05)	.002	-.05	(.05)	.002
Cue → DV	-.11	(.06)	.006 _m	.18	(.05)	.032***	-.07	(.03)	.006
Cue	-.09	(.06)	.005	.18	(.05)	.032***	-.07	(.03)	.005
Threat → DV	.38	(.05)	.096***	.15	(.04)	.029***	.05	(.03)	.005 _m

Safety helmet coupon

Cue → Threat	-.12	(.06)	.01*	-.12	(.06)	.01*	-.12	(.06)	.01*
Cue → DV	-.02	(.07)	.0009	.17	(.05)	.023***	-.05	(.03)	.003
Cue	.03	(.06)	.0001	.19	(.05)	.032***	-.04	(.03)	.002
Threat → DV	.38	(.05)	.102***	.16	(.04)	.029***	.05	(.03)	.004

Cumulative interventions

Cue → Threat	.11	(.02)	.036***	.11	(.02)	.036***	.11	(.02)	.036***
Cue → DV	.04	(.03)	.004	.10	(.02)	.04***	-.009	(.02)	.0004
Cue	-.003	(.03)	.00002	.09	(.02)	.029***	-.02	(.02)	.0009
Threat → DV	.38	(.05)	.102***	.12	(.04)	.014**	.06	(.03)	.005*

Note. Prior helmet ownership, income, education level, and respondent's gender were included as covariates in all analyses. *B* (*SE B*) represents the unstandardized regression coefficient with its standard error, and *s*² represents the squared semipartial correlation (i.e., the unique influence of each independent variable on the dependent variable).

a. Regression estimating perceived threat from a cue (e.g., community event).

b. Regression estimating the dependent variables (i.e., attitudes, intentions, helmet ownership, and helmet usage) from a cue.

c. Regression estimating the dependent variables from both the cue and perceived threat simultaneously.

p* < .05; *p* < .01; ****p* < .001. The subscript *m* indicates marginally significant, *p* < .08.

Parents receiving coupons had significantly decreased perceptions of threat as well as stronger intentions to purchase helmets for their children than parents not getting coupons. Parents who believed they were going to be buying helmets soon may have already viewed their children as helmet wearers and thereby seen their children as being protected against bicycling injuries, which may explain why they perceived less threat of injury for their children. Of course, it would have been interesting to see whether these intentions actually translated into helmet purchases.

The finding that the direct mail message was the only cue that failed to influence perceptions of threat was unusual in that this cue should have been among those eliciting the most perceived threat—because it was a direct manipulation of threatening information. For example, when threatening information about bicycling injuries and accidents was given over the telephone, perceptions of threat increased. However, when the same information was sent in the mail, perceptions of threat decreased. Why would identical information raise perceptions of threat over the telephone but decrease perceptions of threat when mailed directly? One primary difference between the two messages was the medium by which the information was transmitted. These findings indicate that threatening information given over interpersonal channels is more effective than threatening information provided in a print medium. There appeared to be some sort of denial or defensive reaction to the threatening information received in the mail. For example, of those mailed threatening information, 37.1% reported receiving the direct mail message. In contrast, 83.9% of those receiving coupons in the mail reported that they had received the discount coupons. The disparity in these figures is striking in that the only difference between these mailed messages was the content of the message—one contained threatening facts, and the other contained coupons. It appears that those who received the threatening information simply tossed it, whereas those engaging in an interpersonal conversation over the telephone were forced to process the threatening information and subsequently changed their perceptions of threat. Thus, if practitioners choose to use threats or scare tactics, they may have greater success if this information is given interpersonally. It appears that use of an interpersonal channel cuts through any defensive reactions that might emerge in response to threatening messages. However, people can simply choose to ignore a direct mail message.

Even though five of the six cues significantly influenced perceptions of threat, the systematic and consistent patterns shown in Table 4 indicate that cues to action generally do not influence the likelihood of adopting the

recommended action, either directly or indirectly. Occasionally, cues directly led to more favorable attitudes toward safety helmets (i.e., physician counseling) and stronger intentions to purchase helmets (i.e., mass media announcements, direct mail, and coupons). However, it is unknown whether these attitudes and intentions ultimately influenced helmet purchasing or usage. In terms of behaviors, however, none of the cues had any effect. Table 4 shows that perceived threat is an important influence on attitudes, intentions, and behaviors (cf. Schneider, Ituarte, & Stokols, 1993).

How can cues to action influence perceptions of threat but not be even remotely related to behaviors? One explanation is that cues to action may indirectly influence behaviors through *both* perceived benefits and barriers *and* perceived threat—but only under certain conditions. The large body of work on fear appeals suggests that perceived threat and perceived benefits and barriers (loosely defined as “perceived efficacy” by some, Janz & Becker, 1984) interact in predictable manners to influence decision-making processes (see Leventhal, 1970; Rogers, 1975, 1983; Witte, 1992a). Specifically, if individuals believe that they are susceptible to a severe and personally relevant threat and if they believe that they are capable of effectively averting the threat, then they are more likely to adopt the recommended response (Kleinot & Rogers, 1982; Maddux & Rogers, 1983; Rogers & Mewborn, 1976; Witte, 1992b). Cues to action may indirectly influence the likelihood of taking the recommended action only if (a) they depict the threat as severe and probable and (b) they portray the recommended response as effective and easy to do. If the cues address only one of these variables (i.e., perceived threat or perceived benefits and barriers), then they may have no influence on attitudes, intentions, or behaviors. For example, in this study, our cues focused primarily on perceived threat, and we found no effect for cues on behaviors. Because perceived benefits and barriers were not ascertained in our work, we cannot determine whether perceived threat and perceived benefits and barriers act as mediators when combined. These analyses suggest that slight modification of the HBM is in order. Specifically, cues to action should influence both perceived threat and perceived benefits and barriers, instead of perceived threat alone. Future research should (a) examine these variables more closely as potential mediators or moderators in the HBM and (b) examine relevant fear-appeal theories to help explain the results from HBM studies (e.g., see Rogers, 1983; Witte, 1992a).

Overall, perceived threat was shown to be a powerful motivational influence on attitudes, intentions, and behaviors. In all cases, parents who perceived greater threat of bicycle injury had more favorable attitudes

toward safety helmets, had stronger intentions to purchase safety helmets for their children, were more likely to have already bought helmets for their children, and were more likely to insist that their children consistently wear the helmets. Injury control specialists may find it useful to capitalize on perceptions of susceptibility and severity regarding bicycling accidents to promote safety helmet usage. However, it is critical that the effectiveness of safety helmets in preventing injuries also be emphasized.

One intriguing question that has yet to be addressed in the HBM is the directionality of the relationship between cues and perceived threat. Typically, studies testing the HBM argue that cues lead to greater perceptions of threat. However, it is plausible that the reverse is true. That is, strong existing perceptions of threat may cause individuals to seek out relevant cues for additional information, thus reinforcing those strong perceptions of threat. For example, if one believes that his or her child is at risk for serious injury from a bicycling accident, he or she may be especially vigilant in seeking out bicycle safety information. This reciprocal relationship between threat predisposition and cue vigilance seems not to have received a great deal of attention in the literature and offers one direction for future research.

Limitations

The major limitation to this study was the self-report nature of the dependent variables and measures of exposure. First, there was no way to check objectively whether respondents in fact purchased helmets or whether their children consistently used them. However, every effort was made by the trained interviewers to ensure that subjects felt comfortable in giving their honest and complete answers to the interview questions. Second, because exposure to the communitywide cues was measured in a self-report manner, we do not know what the true exposure to the community cues was. For example, we cannot say with certainty how much of the targeted population was exposed to the community cues. However, we do know that those remembering exposure to the communitywide interventions were persuaded of the seriousness and relevancy of bicycling injuries. Third, although physicians were contacted personally by telephone, there is no way to know whether they actually counseled patients to use safety helmets, nor was there any means to check whether the prescription pads were used. However, visits to a number of physicians' offices revealed that the posters were displayed. Finally, one other limitation to the study was our decision not to measure perceived benefits or barriers. If we had measured these variables, a clearer picture of the role of cues to action in promoting protection behaviors might

have emerged. Future research should assess both perceived threat and perceived barriers and benefits to gain a better understanding of how these variables influence health-related decision processes.

Recommendations for Bicycle Injury Control Specialists

The findings from this study suggest three specific recommendations for bicycle injury control specialists. First, before protective responses will be adopted, individuals must feel susceptible to a severe outcome. In this work, increased perceptions of threat about bicycling injuries and accidents were associated with more favorable attitudes toward safety helmets, increased intentions to purchase helmets, and increased helmet ownership and usage. Second, the number of different cues to action is at least as important as the frequency of being exposed to the same cue. Exposure to several different types of cues resulted in a significant increase in perceptions of threat and increased intentions to purchase helmets. Thus it is important that a communitywide health campaign have breadth as well as depth. Third, when using threatening or fear-arousing messages, interpersonal communication channels appear to work better than mass media channels. Threatening messages appeared to break through invulnerability defenses when given interpersonally in this study but not when administered via mass media channels. Threatening messages given over mass media channels may simply be ignored by the audience, whereas threatening messages given interpersonally may force audience members to evaluate a given health risk.

Overall, even though cues to action failed to influence bicycle safety helmet purchase and usage, they did increase awareness of the risks and hazards of riding a bicycle without a helmet. Increasing awareness of the risks of riding without a safety helmet is a necessary first step in promoting bicycle helmet usage. Before individuals will protect themselves against health-related risks, they must feel susceptible to a serious threat. Future work should examine the role of cues to action on both perceived threat and perceived benefits and barriers. In addition, selective attention processes with regard to threatening messages administered at the community level (i.e., mass media messages) should be investigated.

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