

## INJURY SEVERITY AND LIKELIHOOD IN WARNINGS

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## ABSTRACT

Two experiments examined the influence of injury likelihood and severity in warnings on product hazard perceptions (Experiment 1) and behavioral compliance (Experiment 2). In Experiment 1, participants were given a set of front panel labels for 10 household consumer products. Warnings on the labels were constructed by manipulating the likelihood (low vs. high) and severity (low vs. high) of injury. Labels lacking a warning served as controls. Participants rated the product labels under the guise of a marketing study in which most of the questions concerned product familiarity, cost, and label attractiveness. Only one question was of interest which probed the level of hazard posed by the products. The results showed that (1) the presence of a warning increased the products' judged level of hazard, (2) products with high severity warnings were viewed to be more hazardous than products with low severity warnings, and (3) likelihood of injury in the warnings had no influence on hazard perceptions.

Experiment 2 used a chemistry laboratory demonstration task to test the effects of injury likelihood and severity in a warning on compliance behavior (i.e., wearing gloves as directed by the warning). Greater compliance was shown when warned of a more severe injury, but only when the injury was of lower likelihood.

In general, both experiments showed that injury severity influences warning effectiveness to a greater extent than injury likelihood. The results suggest that to inform people of a hazard and to motivate them to comply with a directed behavior, product warnings should communicate the severity of consequences.

## INTRODUCTION

What information do people use to determine the level of hazard posed by consumer products? This question is important because research suggests that hazard perception is closely related to people's willingness to read product warnings (Godfrey, Allender, Laughery, & Smith, 1983; Wogalter, Desaulniers, & Brelsford, 1986; Young, Brelsford, & Wogalter, 1990).

Research also indicates that people's hazard perceptions are largely determined by the extent or severity of injury that might occur with virtually no contribution of how likely the injury might occur (Wogalter, Desaulniers, & Brelsford, 1987; Young et al., 1990). However, research on a related concept "risk" indicates that people's perceptions are determined by combining both severity and likelihood information (e.g., Lawrence, 1980; Slovic, Fischhoff, & Lichtenstein, 1979, 1980).

The methodology employed in previous work examined the relative effectiveness of likelihood and severity information by asking people to judge the hazard of generic names of products (e.g., Wogalter et al. 1986, 1987a; Young et al., 1990) or estimate the frequency or relative likelihood of accident events (e.g., Slovic et al. 1979, 1980). However, no study to date has investigated this issue using a more direct approach in which likelihood and severity information is manipulated in warnings. The present studies examine the effect of injury likelihood (low versus high) and severity (low versus high) information in warnings on hazard perceptions for commercially-available consumer products (Experiment 1) and measures their effect on behavioral compliance (Experiment 2).

## EXPERIMENT 1

Experiment 1 investigated whether injury likelihood and severity information in warnings influences perceptions of

hazard. The study was conducted under the guise of "marketing research" concerned with factors affecting people's decisions to purchase certain consumer products. Participants answered a variety of questions for each of a set of products. One question, which asked how hazardous they perceived the product to be, was of primary interest.

*Method*

*Participants.* Forty-six undergraduates from Rensselaer Polytechnic Institute participated for course credit in introductory psychology courses. Prior to this experiment, a different set of 30 students from the same population participated in a preliminary word rating study.

*Stimuli and materials.* Ten consumer products were chosen to represent a range of potentially hazardous household items (Alcon Optizyme Enzymatic contact lens cleaner, Dow bathroom cleaner, Excedrin extra-strength aspirin, Fresh Start laundry detergent, Kleen-Strip paint thinner, Krylon fixative spray coating, Raid roach and flea fogger, Red Devil lye drain opener, Textra hair mousse, and Trugarde fabric stain protector). Labels from the products' front panels were duplicated using an optical scanner/digitizer (Thunderware Thunderscan), stored and manipulated using a computer and software (Apple Macintosh and Silicon Beach Superpaint), and reproduced using a 300 dot per inch printer (Apple Laserwriter).

Warnings on the front labels of the products were manipulated to differ with respect to conveyed injury likelihood (low versus high) and severity (low versus high) of injury that they conveyed. These two independent variables were orthogonally crossed to form four warning labels for each product: (1) Low likelihood, Low severity, (2) Low likelihood, High severity, (3) High likelihood, Low severity, (4) High likelihood, High severity. This

manipulation was accomplished by changing some of the words in the warnings' verbal statements to convey different levels of likelihood and severity. Likelihood and severity terms were selected for inclusion in this experiment according to their distance on the respective dimensions which were based on results from a preliminary word rating study, which is described below.

Earlier, 30 Rensselaer Polytechnic Institute undergraduates rated a set of terms representing a range of likelihood and severity. Eleven likelihood terms (can, likely, may, might, occasionally, possibility, probable, seldom, a slight chance of, unlikely, and will) were rated on a 9-point Likert-type scale given the question: "What is the *likelihood* of injury implied by this term?" The following numerical and verbal anchors were provided: (0) never, (2) unlikely, (4) likely, (6) very likely, and (8) extremely likely. Ten severity terms (extensive, intense, irreversible, major, mild, minimal, minor, severe, slight, and superficial) were rated using the question: "What is the *severity* of injury implied by this term?" The following the numerical and verbal anchors were given: (0) not severe, (2) slightly severe, (4) severe, (6) very severe, and (8) extremely severe.

For low and high likelihood, the terms "can" (likelihood rating:  $M = 3.40, s = 1.5$ ) and "will" (likelihood rating:  $M = 7.73, s = 0.52$ ) were used, respectively. According to the earlier rating study, these two terms were significantly different in their conveyed likelihood,  $t(29) = 17.3, p < .0001$ . For low and high severity, "mild" (severity rating:  $M = 1.43, s = .77$ ) and "intense" (severity rating:  $M = 6.53, s = 1.07$ ) were used, respectively. These two terms were significantly different in their conveyed severity,  $t(29) = 21.1, p < .0001$ . Using the hair mousse product as an example, the warning statements for the four conditions were: "*Can cause mild eye irritation*" (Low likelihood, Low severity), "*Can cause intense eye irritation*" (Low likelihood, High severity), "*Will cause mild eye irritation*" (High likelihood, Low severity warning), and "*Will cause intense eye irritation*" (High likelihood, High severity) [italics added]. A fifth condition in which no warning was present on the product labels served as a control.

Some of the original product label warnings described more than one hazard (e.g., both consumption and skin contact). For purposes of control, all warnings in the current study warned of a single hazard, usually the first hazard mentioned on the original label. The specific kind of injury described in the warning statements was allowed to vary for compatibility with particular products. For example, the bathroom cleaner warned of consumption problems and the fogger warned of potential respiratory problems.

The warnings were placed in the same location as the original label warning. They were preceded by the signal word CAUTION, and were printed in font sizes and styles that best matched the fonts on the original label. Five booklets were formed having labels for all ten products with each booklet containing two product labels representing each of the five conditions. Labels for each product were balanced across booklets and label order in each booklet was randomized.

Fourteen questions were asked of each product, addressing such items as product familiarity, cost, and label attractiveness. The primary question of interest asked, "How

hazardous is it to use this product?" Participants responded using a 9-point rating scale having the following numerical and verbal anchors: (0) not hazardous, (2) slightly hazardous, (4) hazardous, (6) very hazardous, and (8) extremely hazardous. The other 13 questions were included to disguise the purpose of the study and were not analyzed.

*Procedure.* Participants were initially told that the purpose of the questionnaire was to examine factors that might affect people's decision to purchase certain consumer products that they might see on a store shelf. Participants were given the questionnaire, response sheets, and one of the five booklets of product labels. Participants were told: (1) to move briskly through the questions, (2) to give their first impressions, and (3) to complete all questions for each product before moving to the next product. Approximately equal numbers of participants were given each of the five booklets (nine or 10 students per booklet). After completing the questionnaire, the students were debriefed on the true nature of the study and were thanked for their participation.

### Results

Hazard ratings for the 10 products were collapsed to form mean scores for each condition composed of two product ratings. Thus, each participant contributed five scores to the repeated-measures analyses described below.

The first analysis examined whether hazard perceptions differed due to the simple presence of a warning on the label. A contrast comparing the warning conditions and the no warning condition was significant,  $t(45) = 2.04, p < .05$ , showing that products with warnings ( $M = 2.28$ ) were perceived to be significantly more hazardous than products without warnings ( $M = 1.79$ ).

The second analysis examined differences among the warning conditions. A 2 (high versus low likelihood) X 2 (high versus low severity) repeated-measures analysis of variance (ANOVA) showed a significant main effect of severity,  $F(1, 45) = 6.33, p < .02$ . Products with warnings conveying higher injury severity were judged to be more hazardous ( $M = 2.50$ ) than products with warnings conveying lower injury severity ( $M = 2.05$ ). No significant effect of the injury likelihood nor a significant likelihood X severity interaction was found ( $ps > .05$ ).

### Discussion

The presence of warnings on the front front label increased participants' perceptions of product hazard. Products lacking warnings were perceived to be less hazardous than product with warnings. The results also showed that the content of the warning message is important in affecting perceptions of hazard. Product labels with warnings conveying greater injury severity were perceived to be more hazardous than warnings conveying lower injury severity. The implication of these results is that failure to include a warning message on a potentially hazardous product might lead people to believe that the product is less hazardous than it really is. Even if a warning is present, it needs to give an accurate portrayal of the extent of possible injury. Apparently people use the magnitude of injury as a cue in determining their perceptions of product hazard. Thus, products capable of inflicting substantial injury should describe how badly a person might get hurt; otherwise,

people may believe that the level of hazard is lower than it really is.

While the severity manipulation influenced perceptions of hazard, the results failed to show any influence of injury likelihood. This null result fails to support the suggestion in the risk literature that people's perceptions of risk is influenced by a combination of likelihood and severity information (Slovic et al., 1979, 1980). However, the failure to find an effect of likelihood on perceptions of hazard is in accord with Wogalter et al.'s (1987a) and Young et al.'s (1990) findings that injury severity is the primary determinant of perceptions of hazard.

This experiment, as well as Wogalter et al. (1987a) and Young et al. (1990), examined the influence of likelihood and severity information on perceptions of product hazard. All three of these studies examined their influence using ratings. The assumption has been that perceptions of hazard translates into cautionary behavior. However, this assumption has yet to be directly examined. The ultimate test is whether the warning's content influences people's precautionary behavior. Experiment 2 examines the effect of injury likelihood and severity information in a warning on compliance behavior.

## EXPERIMENT 2

The purpose of Experiment 2 was to determine the effect of injury likelihood and severity information in a warning on compliance behavior. Participants were placed in a chemistry lab and given a set of instructions containing one of four kinds of warnings or instructions lacking a warning. Compliance was measured by recording whether or not they engaged in safety behavior.

### Method

**Participants.** Seventy-nine Rensselaer Polytechnic Institute undergraduates participated for course credit in introductory psychology courses. They were randomly assigned to conditions, each having 16 students except for the control condition which had 15. None had participated in Experiment 1.

**Materials and procedure.** The basic procedure is similar to the laboratory demonstration task described in detail in Wogalter, Godfrey, Fontennelle, Desaulniers, Rothstein, and Laughery (1987) and Wogalter, Allison, and McKenna (1989) with the exception that the warning in the current study directed participants to wear gloves rather than both mask and gloves. Participants were given instructions directing them to measure and mix various "chemicals." These "chemicals" were actually safe substances and solutions (flour, sugar, water, etc.) that were disguised with food coloring to set the appearance that the participants were working with potentially dangerous materials (i.e., that some risk was involved). A large number of disposable plastic gloves were located on the table containing the chemistry equipment.

Four groups of participants received a set of printed instructions. The instructions contained: 1) a short introductory paragraph, which provides a general description of the laboratory task, 2) a warning following the paragraph, and 3) the specific mixing directions. As in Experiment 1,

the four warning conditions were: (1) Low likelihood, Low severity, (2) Low likelihood, High severity, (3) High likelihood, Low severity, (4) High likelihood, High severity. The warning statements used in these conditions were:

- (1) "Contact with skin *can* cause *mild* skin irritation. Wear gloves." (Low likelihood, Low severity);
- (2) "Contact with skin *can* cause *intense* skin irritation. Wear gloves." (Low likelihood, High severity);
- (3) "Contact with skin *will* cause *mild* skin irritation. Wear gloves." (High likelihood, Low severity);
- (4) "Contact with skin *will* cause *intense* skin irritation. Wear gloves." (High likelihood, High severity).

All warning statements were preceded by the signal word WARNING. A fifth group received instructions in which the warning was absent (i.e., the space where the warnings were placed in the other conditions was left blank). Whether the participant put on the gloves before starting to mix the substances was recorded.

### Results

Participants were given a score of "1" if they complied and a score of "0" if they did not. The compliance data were examined using Chi Square analyses. The overall analysis for the experiment was significant,  $X^2(4, N = 79) = 18.28, p < .01$ . This was followed by specific contrasts among conditions. A contrast comparing compliance in the no warning condition with the conditions in which a warning present was significant,  $X^2(1, N = 79) = 13.47, p < .001$ . There was greater compliance when a warning was present (42 of 64 participants or 66%) than when it was absent (2 of 15 participants or 13%). The only significant comparison among the four warning conditions occurred between the Low Likelihood, High Severity warning and the Low Likelihood, Low Severity warning conditions,  $X^2(1, N = 32) = 4.80, p < .05$ . Under lower likelihood, there was greater compliance with the higher severity warning (13 of 16 or 81%) than the lower severity warning (7 of 16 or 44%).

### Discussion

Participants in the chemistry laboratory task more often engaged in precautionary behavior (wearing gloves) when a warning was present than when it was absent. This result supports earlier work (Wogalter et al. 1987b) and indicates that safety-related behavior can be enhanced by information communicated by a warning. Without the warning present, the frequency of precautionary behavior was much lower. While this result is not particularly surprising, it was unexpected to find that two participants put on gloves *without* a warning present directing them to do so. This may be due to the fact that many of the participants had or were currently taking chemistry classes at the university in which similar safety behavior is required.

The results also showed greater compliance when the warning conveyed information of a more severe injury than of a less severe injury. However, this difference was only shown for warnings describing an injury of lower likelihood. The difference between high and low severity was not shown for warnings expressing higher injury likelihood. The reason for the failure to find a difference for

the higher likelihood is not clear. One possibility is that participants in the high likelihood conditions did not believe that harm would *definitely* occur if they mishandled the substances (perhaps from similar previous experience), and thus the warning message was less believable to them. Further investigation would have to be undertaken to test whether likelihood interacts with experiential, situational and/or product factors.

### GENERAL DISCUSSION

Both experiments showed that the presence of a warning increases perceptions of product hazardousness (Experiment 1) and compliance behavior (Experiment 2) compared to its absence. The implication of these findings is that failure to include a warning for a potential hazard might lead people to underestimate the dangerousness involved. A particularly serious error would occur if people make the assumption that no warning means that the product (or situation) is safe. This belief might then translate into behavior that is less cautious than appropriate and possibly leading to injury. Moreover, it underscores the finding by Wogalter et al. (1986) which indicated warnings should be located in close proximity because this is where people expect them to be. If a warning is not located on or near the product people may not see the warning and assume that there is no hazard (Wogalter, Brelsford, Desaulniers, & Laughery, 1990).

Both experiments also showed that warning effectiveness was enhanced by information expressing greater than lesser injury severity. Experiment 1 showed a clear severity effect on product hazard perceptions. Experiment 2 confirmed this, in part, using a behavioral compliance measure. The results showed that a warning expressing higher injury severity produced greater behavioral compliance than a warning expressing lower injury severity, but only when it was accompanied by information imparting lower likelihood of injury. No effect of severity on compliance was found for warnings expressing higher likelihood of injury.

While the two experiments used very different procedures they, nevertheless, showed reasonably consistent findings. They support Wogalter et al.'s (1987a) and Young et al.'s (1990) finding which showed in multiple regression analyses that severity was a more important cue than likelihood in people's judgments of product hazard. It also supports Martin and Wogalter's (1989) suggestion that injury probabilities and frequencies may not be involved in people's decisions to behave cautiously.

Why would injury likelihood play such a minor role in perceptions of hazard and behavioral compliance, yet appear to play a role in other research concerned with perceptions of risk? One possibility concerns the different kinds of tasks involved in the respective research. In studies of perception of risk, Slovic et al. (1979, 1980) asked participants to estimate mortality rates or make comparative judgments of accident frequencies. This kind of judgment *demand*s consideration of likelihoods which might be the reason why a contribution of this factor was found and the present results did not. Apparently, the effects of injury severity on perceptions are so pervasive that they affect judgments of likelihood. For example, Slovic et al. (1979, 1980) found that mortality rates for agents capable of producing severe consequences were overestimated, indicating that there is a

contribution of severity even for judgments strictly concerned with frequency of events. A similar result was noted by Martin and Wogalter (1989).

A second possible reason for the failure to find strong evidence for the influence of likelihood information is that the likelihood of consumer product injury is extremely low. While people are capable of making distinctions between products based upon the frequency of injury (Brems, 1986), the differences between relatively unlikely accident events are probably not considered in everyday judgments of hazard. That is, accidents are so infrequent that people may consider the likelihood of injury to be too small to be of concern. Thus, the most persuasive and vivid cue for judgments of hazard is the potential severity of injury that might occur.

These results indicate that the extent of injury is an important indicator that people use to make judgments about product hazard and to make warning compliance decisions. They also point to the need for warnings to inform consumers about the seriousness of the consequences to motivate them to comply with the directed safety behavior and thus avoid accidents and injury. An implication of these findings is that warning communications should focus more on how badly a person can get hurt than on how likely one will be hurt. In sum, it appears that to increase compliance with precautionary directives and to enhance perceptions of hazards, warnings should emphasize realistic consequences of product use.

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