JUDGMENTS OF HAZARD, RISK, AND DANGER: DO THEY DIFFER?

Stephen L. Young
Department of Psychology
Rice University
Houston, Texas 77251

John W. Brelsford
Department of Psychology
Rice University
Houston, Texas 77251

Michael S. Wogalter
Department of Psychology
Rensselaer Polytechnic Institute
Troy, New York 12180

ABSTRACT

There were three purposes of the present research. The first was to test whether some of the discrepancies found in the hazard and risk perception literature were due to differences between the connotations of the terms *hazard* and *risk*. The second purpose was to examine the relationship between willingness to read warnings and generalized cautious intent, as well as other relevant variables suggested by past literature. The third purpose was to examine the relation between objective measures of injury (e.g., frequencies of hospital emergency room admissions) and people's subjective perceptions. The results showed that the expressions of *hazardous, risky, dangerous* and *hazardous-to-use* connote the same meaning to lay participants. Strong intercorrelations were found between *overall unsafeness* (a composite of the four hazard-risk expressions), injury severity, cautious intent, and willingness to read warnings. While injury likelihood played a small part in the prediction of willingness to read warnings, the results indicated that overall unsafeness (and severity of injury) play the foremost role in people's judgements of whether to read warnings and to act cautiously. No relationship was observed between objective measures of injury frequency and people's subjective perceptions of injury likelihood which is taken as a further indication that people do not readily use injury likelihood in their judgements of product safety.

The implications are two-fold. First, the results suggest that lay persons do not interpret the term risk in the same way as do experts. These results suggest that other terminology and language may be needed to express probability to lay persons. Second, the results suggest that designers of warnings and educational materials should focus their attention to ways that appropriately communicate how badly a person can get hurt, rather than (or to a lesser extent) the likelihood of getting hurt.

INTRODUCTION

It is apparent that in many instances important safety information fails to reach the consumer (Wogalter, Godfrey, Fontenelle, Desaulniers, Rothstein, & Laughery, 1987). Sometimes consumers do not see the warnings and sometimes the warning does not adequately communicate the hazards. However, there are also situations where the consumer does not read a warning that is clearly apparent and that adequately describes the hazards. Why might not warnings be read in this latter case? Research suggests that people may not read warnings on products that they perceive to be safe and familiar. A growing body of research indicates that these beliefs affect people's willingness to look for and read warnings (Godfrey, Allender, Laughery, & Smith, 1983; Godfrey & Laughery, 1984; LaRue & Cohen, 1987; Wogalter, Desaulniers, & Brelsford, 1986). Godfrey et al. (1983) found that looking for warnings on products was positively related to perceived product hazard while negatively related to product familiarity. Similar results have been reported for willingness to read warnings (LaRue & Cohen, 1987; Wogalter et al., 1986). Research also indicates people use perceptions of hazard more than product familiarity in their decisions of whether to read product warnings (Wogalter et al., 1986). Because hazard perception seems to be a critical variable in decision making, subsequent research has investigated the kinds of information that people use to form these perceptions. The results show that hazard perceptions are more strongly predicted by severity of injury than by likelihood of injury (Wogalter, Desaulniers, & Brelsford, 1987).

The finding that likelihood (probability) of injury is not a strong determinant of people's perceptions of hazard does not concur with other research dealing with "risk" perception. For example, Lowrance (1980) and Slovic, Fischhoff, and Lichtenstein (1979, 1980) suggest that risk perceptions are determined by a combination of severity *and* likelihood information. One possible reason for these different formulations is that the terms risk and hazard may differ somewhat in meaning. That is, likelihood considerations may contribute to perceptions of risk, but may not contribute greatly to perceptions of hazard. This may seem like a trivial semantic distinction of the two words' connotations, but it is indicative of a possible source of confusion. This possibility becomes more plausible when it is considered that the term risk *itself* seems to have different connotations in the research literature. A review of the scholarly writing reveals that there is considerable variability in definitions of the term risk. Oppe (1988) points out that risk is sometimes defined in terms of statistical likelihood or probability (objective risk), and sometimes it is used as a synonym for danger or threat (subjective risk). The tendency to employ the objective or subjective definition of risk may be a function of expertise in the field of risk (Lichtenstein, Slovic, Fischhoff, Layman & Combs, 1978). Experts on risk tend to use the term to express likelihood and probability, whereas, lay persons seem to use the term as a synonym for magnitude of hazard and danger. If so, then part of the difficulty experts seem to have in communicating risk information to the public may be due, in part, to the fact that the public interprets the term differently than they do.

The present research had three purposes. The first was to determine whether people judge consumer product "hazard" and "risk" differently. That is, do people connote the same meaning or different meanings to these two terms? In addition, two other expressions, "danger" and "hazardous-to-use," were examined to determine whether they differ from hazard and risk in their connoted meaning. Danger is a term commonly used to describe situations that are termed hazardous and risky. Hazardous-to-use was examined because there is research (Slovic et al., 1980) which suggests that how the question is framed may be responsible for conflicting results. In the present study, the framing of the hazard dimension was varied (general hazard versus hazardous in its use) to determine whether the question framing affects judgements. People might think that a product is generally hazardous for most people, but that it is not hazardous if they are using or controlling it (DeJoy, 1987; Weinstein, 1980). Thus, one purpose of the present study was to determine whether people interpret the four hazard-risk terms or expressions(*hazardous, risky, dangerous, hazardous-to-use*) similarly or differently.

A second purpose was to further investigate a result observed in earlier research showing greater willingness to read warnings on products of greater perceived hazard (Godfrey et al., 1983;

Godfrey & Laughery, 1984; LaRue & Cohen, 1987; Wogalter et al., 1986). Reading warnings is one of several kinds of cautionary behavior that people might employ. Other kinds of cautionary behavior include handling the product carefully, wearing protective equipment, and preventing child access. Wogalter et al. (1987) found that hazard perception and precautionary intent were strongly related in the context of an experiment in which participants made specific judgments (e.g., severity, likelihood and hazardousness) of accident scenarios that they had generated. No study to date has examined whether cautious intent is directly related to willingness to read warnings. Thus, the second purpose was to specifically examine this relationship. Given the results of earlier studies, it was expected that cautious intent would exhibit a strong relationship with willingness to read warnings, perceived hazard and severity of injury, and would exhibit a weak relationship with injury likelihood.

In an attempt to increase the opportunity for likelihood to produce an effect, three different injury likelihood questions were asked: likelihood of *any* injury, likelihood of *minor* injury, and likelihood of *major* injury. Previous research (Desaulniers, 1989) demonstrated that likelihood of a *major* injury, but not of a *minor* injury, related to product hazard perceptions. This distinction between major and minor injury likelihood is examined in the present study. Also, people's perceptions of the likelihood of *any* injury is examined in the event that subjects do not make the distinction between minor and major injury likelihood.

The third purpose was to examine whether people's subjective judgments correspond with objective measures. Databases exist that contain measures of actual accident frequencies (emergency room visits associated with consumer products) and an objective metric of severity of injury. Previous research shows that people are able to directly estimate the frequency with which an accident occurs reasonably well (Brems, 1986; Martin & Wogalter, 1989). However, it is not clear whether requests for more subjective judgments of likelihood relate to objective estimates of accident frequencies. The current study examines whether people's (subjective) ratings of injury likelihood correspond with accident frequency (objective) estimates. Finally, another issue of interest was whether objective likelihood relates to people's willingness to read warnings and cautious intent. The results of Martin & Wogalter (1989) suggests that people do not use accident frequency and judgments of whether they would act cautiously. If the objective accident data are found to relate to people's subjective judgments, this would indicate that people use (or are capable of using) injury frequencies in making their product-related safety judgments. If the objective injury data do not relate to people's subjective judgments, this would be another indication that people do not readily use accident frequencies and likelihoods in their judgments and decision making regarding consumer products.

METHOD

Participants

Thirty-two Rice University undergraduates participated for credit in their introductory psychology courses. An additional set of 38 students participated in a replication.

Materials

Seventy-two generic product names from Wogalter et al. (1986) and Young, Martin & Wogalter (1989) were used. Products were rated on 9-point Likert-type scales anchored from 0 (absence of quantity) to 8 (maximum quantity). Participants were randomly assigned to groups receiving one of four questionnaire booklets. The questionnaire booklets differed with respect to the presence of one of the four question listed below:

(1a) **Hazard**: How *hazardous* is this product? The numerical and verbal anchors were: (0) not at all hazardous, (2) slightly hazardous, (4) hazardous, (6) very hazardous, (8) extremely hazardous.

(1b) **Risk**: How *risky* is this product? The numerical and verbal anchors were: (0) not at all risky, (2) slightly risky, (4) risky, (6) very risky, (8) extremely risky.

(1c) **Danger**: How *dangerous* is this product? The numerical and verbal anchors were: (0) not at all dangerous, (2) slightly dangerous, (4) dangerous, (6) very dangerous, (8) extremely dangerous.

(1d) **Hazardous-to-Use**: How *hazardous* is this product *to use*? The numerical and verbal anchors were: (0) not at all hazardous to use, (2) slightly hazardous to use, (4) hazardous to use, (6) very hazardous to use, (8) extremely hazardous to use.

The remaining items were present in every question booklet:

(2) **Likelihood of Any Injury**: How *likely* are you to receive *any injury* with this product, including all minor ones (requiring little or no first aid) and major ones (requiring emergency room treatment)? The numerical and verbal anchors were: (0) not at all likely, (2) slightly likely, (4) likely, (6) very likely, (8) extremely likely.

(3) **Likelihood of Minor Injury**: How *likely* are you to receive a *minor injury* with this product (requiring little or no first aid)? The numerical and verbal anchors were: (0) not at all likely, (2) slightly likely, (4) likely, (6) very likely, (8) extremely likely.

(4) **Likelihood of Major Injury**: How *likely* are you to receive a *major injury* with this product (requiring emergency room treatment)? The numerical and verbal anchors were: (0) not at all likely, (2) slightly likely, (4) likely, (6) very likely, (8) extremely likely.

(5) **Injury Severity**: How *severely* might you be injured with this product? The numerical and verbal anchors were: (0) not at all severely, (2) slightly severely, (4) severely, (6) very severely, (8) extremely severely.

(6) **Cautious Intent**: How *cautious* would you be when using this product? The numerical and verbal anchors were: (0) not at all cautious, (2) slightly cautious, (4) cautious, (6) very cautious, (8) extremely cautious.

(7) **Willingness to Read Warning**: If you saw a *warning* on this product, how *likely* would you be *to read* it? The numerical and verbal anchors were: (0) not at all likely, (2) slightly likely, (4) likely, (6) very likely, (8) extremely likely.

In the booklets, each question was printed on separate pages. Each booklet was assembled to have a different random order of questions. The product names were listed on two answer sheets with blank spaces where participants recorded their responses.

Procedure

Initially, participants received one of four random orders of products. They were instructed to examine the list before making any ratings to get acquainted with the range of products shown. Two minutes were provided for this familiarization. Participants were told that the products were being introduced by a new manufacturer and had a new brand name. This procedure helped to induce participants to respond to each product generically rather than invoking particular brand names. When given the question booklets, participants were told not to view forthcoming questions (or review earlier questions). They were also told to rate all of the products on the first question before moving on to the next question on the next page.

Table 1. Intercorrelations of Mean Product Ratings

	Overall Unsafeness	Severity of Injury	Caution	Likelihood of Minor	Likelihood of Major	Likelihood of Any	Likelihood of Reading	NEISS Likelihood
Severity of Injury	.985*							
Caution	.977*	.980*						
Likelihood of Minor	.835*	.863*	.867*					
Likelihood of Major	.973*	.981*	.967*	.877*				
Likelihood of Any	.935*	.948*	.945*	.962*	.957*			
Likelihood of Reading	.826*	.805*	.838*	.567*	.767*	.691*		
NEISS Likelihood	-.010	.076	.035	.347	.142	.207	-.135	
NEISS Severity	.148	.162	.141	-.079	-.006	-.068	.326	.018

Note: * = $p < .01$

Measures of objective accident likelihood and estimated severity were obtained from the 1989 National Electronic Injury Surveillance System (NEISS) data base maintained by the U.S. Consumer Product Safety Commission. NEISS provides estimates of emergency room injuries associated with consumer products based on a sample of statistically representative hospitals in the United States. Each product is also assigned a severity value, which is determined by a combination of three factors: injury diagnosis, body part involved, and disposition of the case. Of the 72 products, 24 were available in published lists (e.g., U.S. Consumer Product Safety Commission, 1989), and these were used in the objective data analyses.

RESULTS

The measures which were examined from this data were: hazard-risk, overall unsafeness, willingness to read warnings, cautious intent, objective frequency and objective severity. A reliability check was also performed using the second set of subjects (n=38). The correlations for all of these measures are presented in Table 1.

Hazard-Risk Analysis

Individual participant ratings were combined into mean scores for each of the 72 products. Correlations among the four hazard-risk questions (*hazard*, *risk*, *danger*, and *hazardous-to-use*) showed that they were highly intercorrelated (rs ranged from .93 to .96, ps < .0001) suggesting that they were measuring a similar dimension of judgment. To further confirm this, two analyses of variance (ANOVAs) examined differences among the groups on the four hazard-risk terms. The first ANOVA employed a data set that were collapsed over products and used participant scores as the unit of analysis. The results showed no significant difference among the four questions (Ms = 2.37, 2.35, 2.08, and 2.09 for *hazardous*, *risky*, *dangerous*, and *hazardous-to-use*, respectively, F (3, 284) < 1.0, $p > .05$. The second ANOVA employed data that were collapsed across participants and used products as the unit of analysis. This ANOVA showed no significant difference among the four terms, F (3, 28) < 1.0, $p > .05$, thus confirming the earlier ANOVA. Because these items did not differ, a form of data reduction was performed at this point to make it easier to convey the relationships with the other variables. The data from the hazard-risk terms were averaged creating a single set of *overall unsafeness* scores which were used in all subsequent analyses.

Overall Unsafeness

Regression analysis was used to determine which variables predict the composite variable, overall unsafeness. The highest correlation among the questions was severity of injury (r = .985) accounting for 97% of the variance of overall unsafeness. Multiple regression analysis showed that no other variable contributed significantly beyond severity (ps > .05).

Willingness to Read Warnings

Analyses also examined the variables for predicting likelihood of reading product warnings. The highest correlations were with cautious intent (r = .84) and overall unsafeness (r = .83).

Multiple regression analysis showed that beyond cautious intent ($R^2 = .70$), likelihood of *minor* injury contributed significant variance to the prediction of willingness to read warnings (adding 10% to total 80%, $p < .05$). When cautious intent was not included into the regression, overall unsafeness accounted for most variance (68%) with likelihood of *any* injury contributing a small, but significant 5% (to 73%, $p < .05$).

Cautious Intent

The greatest single predictor of cautious intent was severity of injury ($r = .98$), accounting for 96% of the variance of cautiousness. The only other variable to add significant variance was overall unsafeness which increased the accounted for variance to 97% ($p < .05$).

Objective Injury Frequency

The subjective ratings given by participants were examined relative to the objective measures obtained from the NEISS database. None of the correlations reached significance ($ps > .05$). The NEISS data were further broken down into estimates of cases in which patients were (1) hospitalized or (2) treated and released. Again none of the correlations with the ratings were significant ($ps > .05$)

Objective Severity Rating

The subjective ratings given by participants were examined relative to the objective mean severity measure provided by NEISS. Of specific interest was whether the correlation between participants' perceptions of injury severity and the objective mean severity was related. However, neither this, nor any of the other correlations were significant (p's $> .05$).

Reliability Check

The reliability of these data was examined using a second group of 38 participants who were given the same questionnaire as the first group of 32 participants. The first analysis examined the similarity of the two groups' ratings for the four original hazard-risk terms (hazardous, risky, dangerous, and hazardous-to-use). The reliability coefficients of these items ranged from .92 to .98 ($ps < .0001$). The second analysis examined the reliability of the remaining items in the questionnaire for the two sets of participants. The reliability coefficients ranged from .95 to .99 ($ps < .0001$). Further checks involved the analysis of the second set of data using multiple regression procedures to predict the aforementioned criterion variables. The outcomes were consistent with those already described.

DISCUSSION

The results indicated that the concepts of *hazardous, risky, dangerous,* and *hazardous-to-use* were interpreted similarly by participants in this study. Thus, while experts may define risk as synonymous with likelihood, lay persons (in this case, students) do not see it this way. It is possible that different interpretations might be captured if the question had been framed differently. For example, if the risk question had been framed, "How risky is it to use this product?" rather than the question used in the current research, "How risky is this product?", the responses might have been different. That is, participants might take the view that a product is risky (in general), but under their control, its use would be less risky. However, question framing *was* examined in the present study (*hazardous* vs. *hazardous-to-use*) and the results showed no difference between these two questions. Nevertheless, other ways to frame the questions, other scale anchors and different tasks might alter people's interpretations and responses.

Because the data indicated that all four of the hazard-risk questions were interpreted similarly, a composite score of overall unsafeness was formed from these data and used in all subsequent analyses. Overall unsafeness was found to be most closely linked to severity of injury. This finding supports earlier work on the prediction of hazard perceptions (e.g., Wogalter et al., 1987) but fails to support the notion that people consider likelihood of injury (any, minor, or major) in making judgments of this sort (e.g., Lowrence, 1980; Slovic et al., 1979, 1980).

The results also showed that likelihood of reading warnings and cautious intent were highly correlated. This is not surprising since the act of reading warnings is only one of many different kinds of cautionary behavior that a person might employ. In multiple regression analysis, willingness to read warnings was best predicted by cautious intent and overall unsafeness with some additional unique variance provided by likelihood of injury (any or minor likelihood depending on the analysis). Furthermore, cautious intent was best predicted by injury severity and overall unsafeness. While overall unsafeness (and its closely-tied predictor severity of injury) is the major predictor, likelihood does play some small part in the prediction of willingness to read warnings.

The objective NEISS accident frequencies were not correlated with any of the three injury likelihood questions (likelihood of any, minor, and major injury), nor did they relate to any of the other items rated by participants such as willingness to read warnings and cautious intent. Similar findings have been demonstrated in related research (Dunn, 1972; Dorris & Tabrizi, 1978). Three possible reasons for these null findings can be offered. First, the analysis of just 24 products restricted the range of product variability and thus led to smaller correlations than were found in other analyses using 72 products. However, examination of the scores for the 24 products showed a similar range of scores as the larger group of products. A second reason for the null result is that the tasks inadequately assessed people's use of injury likelihoods. Other tasks in which participants are asked to give numerical estimates (direct or relative) of accident frequencies show that people can give reasonably accurate estimates (Brems, 1986; Martin & Wogalter, 1989). However, these tasks intimately require participants to consider frequencies in order to give responses. The current study did not make this demand of participants: Questions and response anchors indirectly assessed subjective beliefs of likelihood. A third possible reason for the null result is that it correctly indicates that people do not readily use injury likelihood when judging the hazards associated with consumer products. As Martin and Wogalter (1989) point out, accident frequency is apparently not the primary source of information that people use when determining how careful to be.

Why no relationship was found between the objective measure of severity (from the NEISS database) and the subjective ratings is not clear. It might be that people use different information in forming their concept of severity (e.g., voluntariness, risk control, product necessity, degree of exposure, user error) than the information used to form the NEISS severity value (Rethans, 1980; Rethans & Albaum, 1980).

The implications of this work is two fold. One is that lay people interpret risk differently from experts. This suggests that if the expert wants to communicate probabilities and likelihoods to the public, the term risk may not be a good one. Even if probabilities are communicated, people may not see the relevance because they are often expressed in very small numbers and thus do not evoke much concern (Wogalter, Brelsford, Desaulniers, & Laughery, 1990). One promising method of expressing probabilities is to place it into a context of a persons lifespan (e.g., Slovic, Fischhoff, & Lichtenstein, 1978) in order to make it *seem* more relevant and tangible.

The second implication of this research concerns the finding that people use severity of injury as a cue for estimating the degree of hazard and in deciding whether to read warnings and act cautiously. This information would be useful for designers of warnings and educational materials. The present research suggests that they should focus their attention on communicating how badly a person can get hurt, rather than (or to a lesser extent) the likelihood of getting hurt. In short, people need information on the potential severity of injury that might occur to motivate them to comply with the warnings' directives (Wogalter & Barlow, 1990).

REFERENCES

Brems, D. J. (1986). *Risk Perception for Common Consumer Products.* Unpublished Doctoral Dissertation, Rice University, Houston, Texas.

DeJoy, D. M. (1987). The optimism bias and traffic safety. In *Proceedings of the Human Factors Society 31st Annual Meeting* (pp. 756-759). Santa Monica, CA: Human Factors Society.

Desaulniers, D. R. (1989). Consumer product hazards: What will we think of next? In *Proceedings of the Interface 89 - 6th Annual Meeting* (pp. 115-120). Santa Monica, CA: Human Factors Society.

Dorris, A. L., & Tabrizi, M. F. (1978). An empirical investigation of consumer perception of product safety. *Journal of Products Liability*, 2, 155-163.

Dunn, J. G. (1972). Subjective and objective risk distribution. *Occupational Psychology, 46*, 183-187.

Godfrey, S. S., Allender, L., Laughery, K. R., & Smith, V. L. (1983). Warning messages: Will the consumer bother to look? In *Proceedings of the Human Factors Society 27th Annual Meeting* (pp. 950-954). Santa Monica, CA: Human Factors Society.

Godfrey, S. S., & Laughery, K. R. (1984). The biasing effects of product familiarity on consumers' awareness of hazard. In *Proceedings of the Human Factors Society 28th Annual Meeting* (pp. 388-392). Santa Monica, CA: Human Factors Society.

LaRue, C., & Cohen, H. H. (1987). Factors affecting consumers' perceptions of product warnings: An examination of the differences between male and female consumers. In *Proceedings of the Human Factors Society of the 31st Annual Meeting* (pp. 610-614). Santa Monica, CA: Human Factors Society.

Lichtenstein, S., Slovic, P., Fischhoff, B., Layman, M. & Combs, B. (1978). Judged frequency of lethal events. *Journal of Experimental Psychology: Human Learning and Memory, 4*, 551-578.

Lowrance, W. W., (1980). The nature of risk. In R. C. Schwing, & W. A. Albers Jr. (Eds.), *Societal Risk Assessment* (pp. 5-17). New York: Plenum Press.

Martin, E. G., & Wogalter, M. S. (1989). Risk perception and precautionary intent for common consumer products. In *Proceedings of the 33rd Annual Human Factors Society Meeting* (pp. 931-935). Santa Monica: Human Factors Society.

Oppe, S. (1988). The concept of risk: A decision theoretic approach. *Ergonomics, 31*, 435-440.

Rethans, A. J. (1980). Consumer perceptions of hazards. In *Proceedings of the PLP-80*, 25-29.

Rethans, A. J., & Albaum, G. S. (1980). Towards determinants of acceptable risk: The case of product risks. *Advances in Consumer Research, 8*, 506-510.

Slovic, P., Fischhoff, B., & Lichtenstein, S. (1979). Rating the risks. *Environment, 21*, 14-39.

Slovic, P., Fischhoff, B., & Lichtenstein, S. (1978). Accident probabilities and seat belt usage: A psychological perspective. *Accident Analysis and Prevention, 10*, 281-285.

Slovic, P., Fischhoff, B., & Lichtenstein, S. (1980). Facts and fears: Understanding perceived risk. In R. C. Schwing, & W. A. Albers Jr. (Eds.), *Societal Risk Assessment* (pp. 181-216). New York: Plenum Press.

U. S. Consumer Product Safety Commission (1989). *NEISS Data Highlights.* Washington, DC: Author.

Weinstein, N. D. (1980). Unrealistic optimism about future life events. *Journal of Personality and Social Psychology, 39*, 806-820.

Wogalter, M. S., Brelsford, J. W., Desaulniers, D. R., & Laughery, K. R. (1990). *Consumer product warnings: The role of hazard perception.* Manuscript submitted for publication.

Wogalter, M. S., Desaulniers, D. R., & Godfrey, S. S. (1985). Perceived effectiveness of environmental warnings. In *Proceedings of the 29th Annual Human Factors Society Meeting* (pp. 664-668). Santa Monica, CA: Human Factors Society.

Wogalter, M. S., Desaulniers, D. R., & Brelsford, J. W. (1986). Perceptions of consumer product hazards: Implications for the need to warn. In *Proceedings of the 30th Annual Human Factors Society Meeting* (pp. 1197-1201). Santa Monica: Human Factors Society.

Wogalter, M. S., Desaulniers, D. R., & Brelsford, J. W. (1987). Consumer products: How are the hazards perceived? In *Proceedings of the 31st Annual Human Factors Society Meeting* (pp. 615-619). Santa Monica: Human Factors Society.

Wogalter, M. S., Godfrey, S. S., Fontenelle, G. A., Desaulniers, D. R., Rothstein, P. R., & Laughery, K. R. (1987). Effectiveness of warnings. *Human Factors, 29*, 599-612.

Wogalter, M. S., & Barlow, T. (1990). Injury severity and likelihood in warnings. In *Proceedings of the 34th Annual Human Factors Society Meeting*, Santa Monica: Human Factors Society.

Young, S. L., Martin, E. G., & Wogalter, M. S. (1989). Gender differences in consumer product hazard perceptions. In *Proceedings of Interface 89*. Santa Monica: Human Factors Society, 73-78.