Consumer Product Warnings: Effects of Injury Statistics on Recall and Subjective Evaluations

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Research has shown that explicitly worded warnings are judged to be more effective than similar warnings lacking explicitness. One possible way of increasing warning explicitness is to include injury outcome statistics in the warning statement. The heuristic processing model of persuasion would postulate that the impact of persuasive messages, like warnings, is influenced by heuristic cues such as the number and length of arguments and the presence of statistics. This research investigated the effect of embedding injury outcome statistics in the safety instructions for electric power tools. Warning statement recall and various rating judgments were measured. Results showed that the presence of statistics led to greater recall and higher ratings of warning importance, vividness, and explicitness. Implications for the design of consumer product warnings are discussed.

INTRODUCTION

The U.S. Consumer Product Safety Commission (CPSC) estimates that on average there are 21,400 deaths and 29.4 million injuries each year related to consumer products under its jurisdiction (CPSC, 1998). Many of these injuries could be avoided if people read and complied with warnings and safety instructions in product manuals. Unfortunately, even if consumers read the safety information, it is often vague and does not adequately convey the nature and extent of hazards associated with product use. One way to increase the likelihood that important safety information is successfully communicated and complied with is to make it more explicit.

Laughery, Vaubel, Young, Brelsford and Rowe (1993) defined explicitness as "the specificity or detail with which potential injury consequences are described." Research has shown that explicit warnings produce higher ratings of product hazard level, cautious intent, and perceived injury outcome severity (Laughery & Stanush, 1989). Explicitness has also been found to result in greater warning instruction recall (Trommelen & Akerboom, 1994).

In previous studies (Trommelen & Akerboom, 1994; Laughery & Stanush, 1989) warning explicitness has been manipulated by adding a description of potential injury outcomes to an existing warning or by replacing vaguely worded outcome descriptions with more detailed ones. The present research extends this work by examining whether another method of increasing explicitness, adding injury outcome statistics to warnings, increases measures of effectiveness. While statistics such as outcome probabilities have been included in the manipulations of some studies, no previous research has systematically compared warnings with and without injury statistics to determine their specific influence.

One purpose of warnings is persuasion. Warnings attempt to change inappropriate attitudes and beliefs regarding product hazards and consequences to more appropriate ones (Laughery & Wogalter, 1997). Most information processing models of persuasion assume that message recipients systematically analyze the content of persuasive messages. However, the heuristic processing model of persuasion (Chaiken, 1980) claims that people frequently do not exert much cognitive effort when evaluating persuasive messages. Instead, their evaluations of persuasive arguments are based on heuristic cues such as the attractiveness of the message source, the number and length of arguments presented, and the presence of supporting statistics. According to the heuristic model, an argument supported by statistics will be perceived as more valid than an argument without statistics.

The involvement of the message recipient is a factor affecting whether persuasive messages will be processed heuristically. If the personal relevance of the message is low, then the message is more likely to be processed heuristically than systematically. In the present study involvement was manipulated by varying the task instructions.

The present research investigated whether the presence of statistics in consumer product warnings benefits various measures of effectiveness compared to similar warnings containing no quantitative information. Based on the heuristic processing model it was expected that warnings with quantitative information including statistics would be more likely to be recalled and would be judged as more effective than similar warnings without quantitative information. Both valid and invalid statistics were included to determine whether it is the value of the statistic or its mere presence that influences warning effectiveness. In addition, warnings with statistics were compared to warnings containing ver

Table 1. ***Warning manipulations for each of five hazards associated with power tools. Manipulations are shown in the order: no quantitative information, verbal quantifier, valid statistic, and invalid statistic.***

Fire
- Sparks from power tools can ignite materials.
- Last year a small number of house fires reportedly were caused by power tool accidents.
- Last year 126 house fires reportedly were caused by power tool accidents.
- Last year 126,000 house fires reportedly were caused by power tool accidents.

Electrical Shock
- Power tools contain live electric circuits.
- Since 1990 a considerable number of persons have received electric shocks while using power tools.
- Since 1990 nearly 8000 persons have received electric shocks while using power tools.
- Since 1990 18 persons have received electric shocks while using power tools.

Eye Injuries
- Power tools may cause dust and debris to become airborne.
- Each year a considerable number of power tool users suffer eye injuries.
- Each year over 13,000 power tool users suffer eye injuries.
- Each year over 13,000,000 power tool users suffer eye injuries.

Hazards to Children
- Power tools aren't toys; children shouldn't play with them.
- A small number of all power tool injuries are suffered by children.
- Approximately 2% of all power tool injuries are suffered by children.
- Approximately 92% of all power tool injuries are suffered by children.

Hand and Finger Lacerations/Amputations
- Holding a workpiece with your hand while using power tools is dangerous.
- A great number of power tool injuries involve lacerations and amputations of hands and fingers.
- 63% of all power tool injuries involve lacerations and amputations of hands and fingers.
- 99.96% of all power tool injuries involve lacerations and amputations of hands and fingers.

quantifiers of amount so that the impact of having an actual numerical value in the warning could be assessed.

METHOD

Participants

Eighty North Carolina State University undergraduates (mean age 20.9 years, SD = 3.7 years) enrolled in introductory psychology classes participated. Participants were randomly assigned to one of four between-subjects conditions.

Design and Materials

A 2 (product type) x 2 (involvement level) x 5 (warning type) mixed-model design was used. Product type and involvement level were between-subjects variables, while warning type was a within-subjects variable.

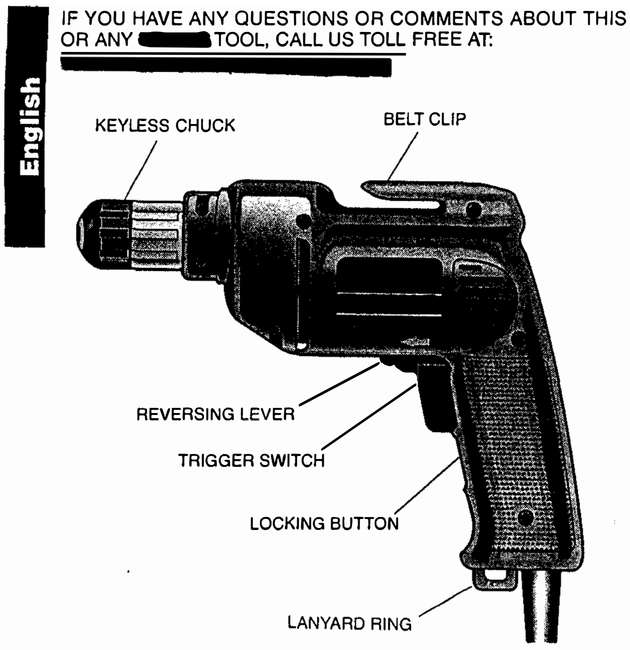
Product type was manipulated by using two different product instruction manuals. Participants were exposed to a product manual for either a circular saw or a variable speed drill. Two tools were used to determine whether effects are consistent across multiple product manuals.

The five warning type conditions were: no warning (control), warning with no quantitative injury outcome information (no quantitative information), warning with injury outcome information presented using a verbal quantifier based on valid statistics (verbal quantifier), warning with a valid injury outcome statistic (valid statistic), and warning with an invalid injury outcome statistic (invalid statistic). Valid statistics were generated from injury data supplied by the CPSC (1996). Invalid statistics were many times higher or lower than the valid statistics. Both valid and invalid statistics were included to determine whether it is the value of a statistic or its mere presence that is important. Warnings in the verbal condition included a verbal quantifier of amount (e.g., "a small number" or "a considerable number") that was found through pre-testing to be approximately equal in meaning to the valid statistical value. In the no quantitative information condition the statistical value was replaced by a statement further describing the potential hazard. Warnings in all experimental conditions were made as similar as possible in length and structure.

Warning instructions similar in content and style to those found in power tool product manuals were used. Each warning instruction consisted of three sentences, the second of which was manipulated. In the no warning (control) condition the entire instruction was absent. Statements were created for each of five potential hazards associated with electric power tools. The hazards were electrical shock, fire, hand and finger lacerations and amputations, eye injuries, and hazards to children. Table 1 shows the manipulated portion of the warning instructions for each hazard and warning type.

The warning instructions were presented in product instruction manuals. The product manuals were photocopied

Figure 1. *Safety instruction page from drill manual.*



Safety Instructions For All Tools

- ***KEEP WORK AREA CLEAN.*** *Cluttered areas and benches invite injuries. Store tools properly when not in use.*
- ***AVOID EXPLOSION AND FIRE.*** *Sparks from power tools can ignite materials. Do not use the tool in the presence of flammable liquids or gases.*
- ***KEEP CHILDREN SAFE.*** *A small number of power tool injuries are suffered by children. Do not let children or other visitors into the work area.*
- ***USE RIGHT TOOL.*** *Don't force small tool to do the job of a heavy-duty tool. Don't use tool for purpose not intended.*
- ***DRESS PROPERLY.*** *Do not wear loose clothing or jewelry. Wear protective hair covering to contain long hair.*
- ***PROTECT YOUR EYES.*** *Each year over 13,000,000 power tool users suffer eye injuries. Always wear safety glasses while working.*
- ***SECURE WORK.*** *63% of all power tool injuries involve lacerations and amputations of hands and fingers. Use clamps or a vice to hold workpiece.*
- ***AVOID UNINTENTIONAL STARTING.*** *Don't carry tool with finger on switch. Be sure switch is off when plugging in.*

reproductions of actual power tool manuals shipped with products. The original manuals contain diagrams and descriptions of the product, instructions for operation, warranty information, a phone number to call for help, and two to three pages of safety instructions. They are printed in English, French, and Spanish and contain between 20 and 30 safety and warning instructions.

The manuals used in the study were made to appear as close as possible to the originals but included only English text and only eight warning instructions. Four of the instructions, those describing electric shock, fire, eye, laceration, and child hazards were manipulated as described above. The instruction for the hazard in the no warning condition did not appear in the manual. The other four had the same format as the manipulated instructions but served only as fillers to make the safety instruction page of the manual appear realistic. The remaining safety instructions from the original manuals were not included because the added verbiage might have distracted participants from attending to the manipulated information. Also, additional instructions could have discouraged participants from reading this section of the manual at all. Figure 1 shows a sample safety instruction page from the drill manual.

The manipulated warning instructions were presented in the manuals based on two balanced 5x5 Latin Squares such that each participant was exposed to one instruction at each level of warning type. Each row of the Latin Squares represented a different warning type by hazard combination. A total of ten versions of the safety instruction page (one representing each row of the Latin Squares) were produced for each product manual. For a given product the manuals were identical except for the contents of this page.

All warning instructions (both manipulated and filler) had the same format. Each consisted of three sentences. The first was a brief directive (e.g., KEEP CHILDREN SAFE) printed in bold, italicized, 11-point, Helvetica type. The third sentence explained how to avoid the hazard (e.g., Do not let children or other visitors into the work area.) The second sentence of the warning instructions was manipulated, or for the filler instructions, gave further information about how to avoid the hazard. The second and third sentences were printed in italicized, 11-point, Helvetica type.

Procedure

Participants were seated at a table with a number of power tool product manuals scattered in front of them. The nature of the experimental task was explained. In the high involvement condition participants were told that the experimental task required them to use an electric power tool to saw or drill some wood and then comment on the tool's ease of use. Participants in the low involvement condition were instructed that the task was to evaluate the usability of a power tool product instruction manual. In neither condition did participants actually use the tool. A brief demographic survey was then administered. Next, a product manual was presented and participants were told they would have five minutes to look through it. After five minutes the manual was removed and participants completed a recall measure and then rated each product hazard (fire, electrical shock, eye injuries, hazards to children, and lacerations and amputations) on the dimensions of hazard level, likelihood of injury, and likelihood of compliance. Ratings were made on 7-point

Likert-type scales with lower numbers indicating a lesser degree of hazard or decreased likelihoods.

Next, the manipulated warning instructions were presented again without the rest of the product manual. The instructions appeared just as they appeared in the manual except that the instruction for the hazard in the no warning condition was included on the sheet. This instruction was shown with a blank line printed in place of the manipulated warning statement (the second sentence of the instruction). Participants rated the five manipulated warning instructions on the dimensions of believability, importance, explicitness, and vividness. This task was followed by additional questionnaires that will not be described in this report. Finally, during debriefing the true nature and purpose of the experiment was explained to participants.

RESULTS

Instruction recall was used as one measure of warning effectiveness. One point was awarded for each instruction correctly recalled. Correctness was judged by the presence of certain keywords or phrases in participant responses. If any or all of the keywords or phrases were included in the response the entire the response was scored as correct. If none of the keywords or phrases were present, the response was scored as incorrect.

Recall of the warning instructions as a function of warning type is shown in Table 2. A 2 (product type) X 2 (involvement level) X 5 (warning type) mixed model analysis of variance (ANOVA) revealed a significant main effect of warning type, $F(4, 304) = 6.88, p < .0001$. A planned comparison between groups showed significantly better recall of the warning instructions presented with quantitative information (valid statistic, invalid statistic, and verbal quantifier conditions) than without (no quantitative information and no warning conditions), $p < .001$.

The ratings of hazard level, likelihood of injury, and likelihood of compliance were analyzed as a function of experimental condition. A series of 2 (product type) X 2 (involvement level) X 5 (warning type) mixed model ANOVAs failed to find any significant main effects or interactions, *ps* > .05.

Warning quality was assessed by ratings of instruction believability, vividness, explicitness, and importance. The quality rating means as a function of warning type are shown in Table 3. Significant main effects of warning type were found for: believability, $F(4, 304) = 8.38, p < .0001$; importance, $F(4, 304) = 2.98, p < .02$; explicitness $F(4, 304) = 15.60, p < .0001$; and vividness, $F(4, 304) = 21.91, p < .0001$. Post hoc analyses using Tukey's HSD procedure revealed that instructions presented in the no warning (control) condition were significantly less believable and less vivid than those presented in any of the manipulated conditions. Instructions containing either valid or invalid statistics were rated significantly more vivid and more explicit than similar instructions with a verbal quantifier inserted in place of the statistic. In addition, instructions containing invalid statistics were rated as more vivid than similar instructions with no quantitative information. Instructions in the no warning condition were perceived to be less explicit than those in the no quantitative information, valid statistic, and invalid statistic conditions. Lastly, instructions containing valid statistics were judged more important than instructions without quantitative information.

Table 2. ***Warning Instruction Recall as a Function of Warning Type Condition***

Warning Type	Proportion of Participants Recalling Instruction
No Warning	0.138
No Quantitative Info.	0.362
Verbal Quantifier	0.425
Valid Statistic	0.362
Invalid Statistic	0.512

DISCUSSION

Results support the use of injury outcome statistics in consumer product warnings. Power tool warning instructions containing a valid or invalid statistic or a verbal quantifier of amount were more likely to be recalled than instructions without any quantitative information. In addition, warnings with valid statistics received higher importance ratings than similar warnings containing no quantitative information, and warnings with numerical statistics (either valid or invalid) were rated as more vivid and more explicit than those containing only a verbal quantifier. These findings support the heuristic persuasion model which says that the simple

Table 3. ***Mean Quality Ratings by Warning Type***

	Rating Dimension			
Warning Type	**Believability**	**Vividness**	**Explicitness**	**Importance**
No Warning	4.59	2.81	3.56	6.39
No Quantitative Info.	5.25	4.03	4.49	6.19
Verbal Quantifier	5.28	3.67	4.16	6.29
Valid Statistic	5.67	4.30	4.96	6.59
Invalid Statistic	5.53	4.80	5.10	6.42

presence of a numerical statistic can enhance the persuasiveness of a message.

No significant differences were found between warnings with valid versus invalid statistics. Warning instructions that inflated or deflated injury statistics by as much as three orders of magnitude were rated to be just as believable as warnings that included the true values. Either participants had no idea of the magnitude of power tool related injuries or, as the heuristic model suggests, they were unable to devote the cognitive capacity required to judge the validity of the statistical values. The mere presence of a number in a warning appears to be more important than the actual numerical value.

Although some aspects of the heuristic processing model were confirmed, others were not. No effect of involvement was found. Also, the experiment failed to show significant differences between conditions on the traditional measures of warning effectiveness (hazard level, likelihood of injury, likelihood of compliance). These findings are most likely due to the subtlety of the manipulations. Only four sentences in six pages of product information were manipulated. Also, to increase the realism of the task scenario, participants were not specifically instructed to read the warning information and were given only five minutes to look over the manual. Given these constraints it is quite likely that a number of participants in both the high and low involvement conditions either skipped the warning instructions completely or quickly scanned over them while searching for more task relevant information.

The results of this study have implications for the design of consumer product warnings. A far greater number of people are injured using common products than most consumers likely believe. For example the CPSC (1996) estimates that in 1995 over 17,000 people required emergency room treatment for injuries associated with vacuum cleaners, a product most consumers would perceive as relatively safe. It is possible that with more explicit warnings fewer people would be injured. The present research showed that the incorporation of injury statistics in consumer product warnings not only increases recall but also strengthens their persuasiveness.

One problem with presenting injury statistics with products might be hesitance on the part of manufacturers to supply such information for fear that it will negatively impact sales. While no research has examined this issue specifically, previous studies suggest that explicit warnings have little effect on purchase intentions (Vaubel, 1990) or may even increase the likelihood of purchase because of the perception that the manufacturer has greater concern for consumer safety (Ursic, 1984).

Another argument against presenting injury statistics with products could be that obtaining accurate injury data is a difficult and expensive task. The injury statistics available from the CPSC and other sources are estimates for broad classes of consumer products and would likely overestimate the hazard associated with a single product. Fortunately, this research showed that the validity of the statistical information is not important. Grossly invalid statistics were just as effective as valid numbers.

Further research is needed on the impact of statistics in warnings for other consumer products. No significant effects of product type were found suggesting that findings may be generalizable to other products. Warnings with statistics might be most effective for products where a large number of non-severe injuries are sustained. For such products the hazards may not be obvious, and it is likely that less explicit warnings might be overlooked or disregarded. Other research could examine the use of statistics in combination with other warning design parameters such as color and icons. For example, different colored poison icons could be placed on products based on the number of past poisoning accidents associated with the product. Future research might also focus on the best way to present statistical information in warnings. Perhaps graphical presentation of injury statistics would facilitate greater recall than embedding statistics in text.

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