WARNINGS AND PURCHASE INTENTIONS FOR PEST-CONTROL PRODUCTS

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We investigated the variables associated with people's willingness to read warnings on household pest-control products and their likelihood of purchasing these products. Seventy college-aged and 20 older participants examined a set of pest-control products and responded to a questionnaire assessing perceptions of the products, the packaging, and the warnings. Results show that product hazardousness, warning understandability, and warning attractiveness were strongly related to people's willingness to read the warnings. A different set of variables was related to purchasing intentions. Participants reported greater willingness to purchase products that were more familiar and had more attractive packaging. Participants were more willing to read warnings that contained more statements and had readability scores at higher grade levels, a result that appeared to be due to their common relationship with perceived hazard. We discuss the results with respect to the relative independence of the variables related to willingness to read warnings and purchasing intentions. Findings suggest that manufacturers can place appropriate and effective warnings on pest-control products without necessarily reducing buying intentions.

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On the basis of a sample of representative hospitals in the United States, the National Electronic Injury Surveillance System estimated that in 1988, 14,736 people were admitted to emergency rooms for pesticide product-related injuries (U.S. Consumer Product Safety Commission, 1988). Of these injuries, 88.3% were released after medical treatment, whereas 11.7% resulted in hospitalization. Most pest-control products contain warnings and instructions for the purpose of warning consumers against misuse and accidents. Despite the presence of warnings and widespread publicity in the media, the number of injuries involving pesticides suggests that people may not be adequately aware of the potential hazards and misuses.

In this research we examined people's perceptions of one category of consumer pesticides: household pest-control products. Interest was focused on the variables associated with willingness to read warnings, warning comprehension, and the likelihood of purchasing pest-control products.

Reading Warnings

Reading the product label is important because it serves as a primary means of communicating correct use and associated precautions. One purpose of this research was to investigate the variables associated with people's willingness to read product warning labels. Several previous studies have provided information that address this issue. Using a list of 60 products, Wright, Creighton, and Threlfall (1982) found that people reported that they would be less likely to read instructions for products used frequently or that were simple to use. Claims to reading instructions, however, were not related to subject age, perceptions of product safety, familiarity, or cost. Godfrey and Laughery (1984) surveyed women on their awareness of the hazards of tampon use, knowledge of the symptoms of toxic shock syndrome, and awareness of warnings. They found that women who were more familiar with tampon products were less likely to notice warnings when they switched brands. Godfrey, Allender, Laughery, and Smith (1983) collected participants' impressions of eight generic names of common consumer products (e.g., plant food, oven cleaner, pesticides). They found that people

would be more likely to look for warnings on less familiar and more hazardous products. For products that were most hazardous (e.g., pesticides), the degree of familiarity with the product did not matter. People still reported that they would look for and read warnings on hazardous products regardless of their familiarity.

Further evidence for the minor importance of familiarity when predicting willingness to read warnings comes from a study by Wogalter, Desaulniers, and Brelsford (1986). Ratings of 72 various consumer products indicated that the perceived hazardousness was the most important determinant of willingness to read warnings. Although familiarity was negatively related to willingness to read warnings, it did not substantially increase predictability beyond hazard perceptions alone.

Thus, prior research suggests that reading warnings can be predicted from perceptions of hazardousness, and to a smaller extent, from familiarity. Participants in these studies, however, rated a wide range of product categories (except Godrey & Laughery, 1984). The stimuli were generic product names (e.g., bicycles, bleach), not actual products (e.g., viewing a specific make of bicycle or a bottle of bleach). People's judgments of generic products from memory may be different from those made when considering specific products that are in view. In this study we used a more ecologically valid approach than that used in most previous research on this topic by collecting judgments for actual products and warning labels. In addition, we used products within a single category (pest-control products) rather than products that span the range of consumer goods available in the marketplace. The purpose was to determine whether the variables found to be important in earlier research using a diverse range of products would also be found important when judgments are limited to products within a single category. If so, perceptions of hazardousness and familiarity should be useful predictors of reading warnings.

Warning Comprehensibility

A second purpose of this research was to determine whether warning comprehensibility would be related to willingness to read warnings. The importance of comprehensibility of warnings is

self-evident: Warnings need to be understood to be effective. Comprehensibility was assessed in two ways: (a) Participants rated the warnings on understandability and (b) we analyzed the warning text by using several objective measures of readability. Because most warning guidelines (e.g., FMC, 1985; Peters, 1984; Westinghouse, 1981; Wogalter et al., 1987) recommend that well-designed warnings should be concise and written for people who read on a low grade level, we expected that people would be more willing to read shorter, more understandable warnings.

Purchasing Likelihood

A third purpose of this research was to examine whether purchasing intentions would be related to the same variables that are associated with willingness to read warnings and if not, to determine which other variables would relate to pest-control product purchasing intentions. We investigated this issue because of the often-heard claim by manufacturers in litigation cases who did not want to include strong (and perhaps more effective) warnings on their products: It will scare consumers and decrease sales (Laughery & Stanush, 1989). Research questions the concern that warnings will decrease prospective sales. Indeed, the limited research available on this suggests that warnings might have a positive influence on consumers. Ursic (1984) found that the presence of a warning increased perceptions of product effectiveness and safety compared with the absence of a warning. Laughery and Stanush (1989) had participants rate warnings for various products on the basis of the specificity of consequences (explicitness). They found no linear relationship between warning explicitness and likelihood of purchasing the products. Given these results, manufacturers' claims that product warnings inhibit sales may not be valid. We reexamined the relationship between purchase decisions and variables related to product warnings.

Method

Subjects

Seventy full-time freshmen and sophomores at the University of Richmond, 37 males and 33 females (aged 17–19 years), participated for class credit in their introductory psychology course. A second group of 20 older adults (M = 37 years, SD = 7.7 years) who were in part-time undergraduate night classes were paid $2 for their participation.

Four pesticide experts were asked to evaluate the products' hazardousness. One was employed by the Virginia Department of Health's Toxic Substance Information Department, one was with the Virginia Department of Agriculture in the Consumer Services Office of Pesticide Regulation, and two were administrators in separate professional pest-control organizations.

Materials and Procedure

Twenty-six household pest-control products available over the counter in hardware, drug, or grocery stores were purchased. All of the products claimed to control roach problems. Flying-insect sprays and agricultural pesticide products were not included. Product brands were selected if they were sold by at least three chain stores in the Richmond, Virginia, metropolitan area. Of the original set, four were roach traps that did not contain warnings on the packaging. Because our primary interest was to examine the variables related to reading warnings, we do not discuss analyses of the trap data here. The 22 products were categorized by type. Fumigators included Hobbs and Raid. Foggers included Black Flag, Hot Shot, Raid, Rid-a-Bud, d-Con, No-Roach, Real Kill, and TNT. Sprays included Black Flag, d-Con, No-Roach, Real Kill, Combat, Hot Shot, Raid, and TAT. Controller systems included Black Flag, d-Con, Combat, and Raid.

A product perception questionnaire was used to assess participants' perceptions of the products' packaging, labeling, and warnings. Responses were recorded using 9-point Likert-type scales ranging from 0 (*absence of quantity*) to 8 (*maximum quantity*). Items from the questionnaire are as follows:

1. How *hazardous* do you think the product is (0 = not at all hazardous, 2 = somewhat hazardous, 4 = hazardous, 6 = very hazardous, and 8 = extremely hazardous)?
2. How *familiar* are you with this product (0 = not at all familiar, 2 = somewhat familiar, 4 = familiar, 6 = very familiar, and 8 = extremely familiar)?
3. How likely is it that you would *read* the warning on the back (or side) panel of the package (0 = never, 2 = unlikely, 4 = likely, 6 = very likely, and 8 = extremely likely)?
4. How *understandable* is the warning on the back (or side) panel of the package (0 = not at all, 2 = somewhat understandable, 4 = understandable, 6 = very understandable, and 8 = extremely understandable)?
5. How *attractive* (appealing) is the *warning* label on the back (or side) panel of the package (0 = not at all attractive, 2 = somewhat attractive, 4 = attractive, 6 = very attractive, and 8 = extremely attractive)?
6. How *attractive* (appealing) is the *packaging* of this product in general (0 = not at all attractive, 2 = somewhat attractive, 4 = attractive, 6 = very attractive, and 8 = extremely attractive)?
7. How *strong* (potent) do you think the product is (0 = not at all strong, 2 = somewhat strong, 4 = strong, 6 = very strong, 8 = extremely strong)?
8. How *careful* would you be when using this product (0 = not at all careful, 2 = somewhat careful, 4 = careful, 6 = very careful, and 8 = extremely careful)?
9. How likely are you to be *injured* in any way while using this product (0 = never, 2 = unlikely, 4 = likely, 6 = very likely, and 8 = extremely likely)?
10. How *difficult* would it be to use this product (0 = not at all difficult, 2 = somewhat difficult, 4 = difficult, 6 = very difficult, and 8 = extremely difficult)?
11. How likely are you to *purchase* this product (0 = never, 2 = unlikely, 4 = likely, 6 = very likely, and 8 = extremely likely)?

All 22 products contained the same basic three-line front panel warning:

KEEP OUT OF REACH OF CHILDREN

CAUTION

See back (side) panel for additional precautionary statements

This front panel warning is required by the 1985 Federal Insecticide, Fungicide, and Rodenticide Act (McKenna, Conner, & Cuneo, 1987). Because the front panel warning was nearly identical for all products, we do not report other items of the questionnaire assessing its perception here. Rather, we focus on perceptions of the longer back (or side) panel warnings.

The larger study also included collection of participant demographics and product-related data. The demographic information included sex, age, place of residence, prior pest-control problems, and previous use of pest-control products. Products were coded for objective characteristics such as chemical contents (e.g., percentages of active and inert ingredients), duration of effectiveness, pests they are effective against, packaging characteristics, and warning characteristics (e.g., location on package, text formatting, size, and color). The content of the warnings were also categorized and coded, including mention of symptoms, antidotes, danger to pets, notes to the physician, and poison hot line information. We do not present the demographic and the objective product characteristics data in this article.

Product perception procedure. Participants were separated into groups of 3–8. The pest-control products were placed on tables in a large room, and each product had a numbered identification placard next to it. After completing a demographics questionnaire, participants were given the product perception questionnaire and a booklet of randomly ordered response forms. Participants were told that each response form was numbered to correspond to one of the products in the room, that each of the products was to be examined in the order indicated by the response form packet, and that the questionnaire was to be completed for each product before going on to the next one. Participants were allowed to handle the products, but

for safety reasons, participants were prevented from using the products (i.e., the nozzles of all aerosol products were removed).

Readability measures. Measures of readability for the back and side panel warning text were obtained. Because many statements on the containers lacked punctuation, it was added prior to the readability assessments where appropriate to avoid erroneous sentence-length scores. Each label was analyzed for the number of words, number of statements, and two measures of reading grade level: the Flesch (1948) index as modified by Gray (1975) and the Coleman and Liau (1975) index. Because it was difficult to distinguish between warnings and instructions, we defined warnings as all text containing signal words; directions for preparation, proper use, storage, and disposal; and any information that described physical, chemical, and environmental hazards.

Results

Participant ratings for each product and question were collapsed, which produced 22 product mean scores for each of the rated questions. These scores (pest-control products) were used as the random variable in the analyses. There were significant linear relationships between the experts' mean hazardousness ratings and the hazardousness ratings by younger ($r = .78$, $p < .001$) and older ($r = .61$, $p < .001$) participants. In addition, there was a positive linear relationship between ratings by younger and those by older participants ($r = .76$, $p < .001$). A one-way analysis of variance showed that there were no significant differences among the mean hazard ratings of the three groups, $F(2, 42) = 2.06$, $p = .14$.

Willingness to Read Warnings

One purpose of this research was to determine the variables that would be correlated with willingness to read warnings on the pest-control products. Data from the younger and older participants were examined in separate analyses.

Younger adults. Table 1 shows that willingness to read warnings was significantly and positively related to product hazardousness, warning understandability, warning attractiveness, carefulness, and likelihood of being injured while using the product.

Older adults. Table 1 also shows that the pattern of relationships for the older participants was similar to that of the younger participants, except that the magnitudes of the correlations were smaller. For the older participants, willingness to read warnings was significantly and positively related to hazardousness, warning understandability, and warning attractiveness. In addition, perceived strength of the product and difficulty of use was positively related to willingness to read warnings.

Readability Measures

A second purpose of this research was to examine whether several objective measures of the warning readability (statements, words, and grade level) would be related to the willingness-to-read variable. Willingness to read was significantly related to the number of

TABLE 1 Correlations Between Willingness to Read and Likelihood of Purchasing Pest-Control Products With Perception Variables for Younger and Older Adults

	Younger adults		Older adults	
Characteristics of pest-control products	Read warning	Likely to purchase	Read warning	Likely to purchase
Hazardousness	.64**	−.43*	.50*	.06
Familiarity	−.04	.95**	.19	.86**
Warning understandability	.93**	.03	.89**	.29
Warning attractiveness	.89**	.12	.69**	.37
Package attractiveness	−.10	.78**	.26	.77**
Strength	.35	.76**	.52*	.46*
Carefulness in use	.51*	−.40	.24	−.24
Likelihood of injury	.45*	−.48*	.29	−.09
Difficulty of use	.23	−.46*	.45*	−.18

*$p < .05$.
**$p < .01$.

statements in the warnings (for the younger adults, $r = .61$, $p < .01$; for the older adults, $r = .44$, $p < .05$), but the relationship between willingness to read and the number of words was not significant (for the younger adults, $r = .41$, $p > .05$; for the older adults, $r = .34$, $p > .05$). Willingness to read the warnings was positively related to the Flesch grade-level index (for the younger adults, $r = .55$, $p < .01$; for the older adults, $r = .46$, $p < .05$) and the Coleman–Liau grade-level index (for the younger adults, $r = .45$, $p < .05$; for the older adults, $r = .49$, $ps < .05$). According to both readability indexes, the warnings were written, on average, at the 10th-grade reading level.

The readability measures were also examined with respect to perceptions of product hazardousness. The younger adults' ratings of product hazardousness were significantly related to the number of statements in the warnings and the Flesch reading-level scores ($r = .60$ and .58, respectively, at $p < .01$). The older adults' hazardousness ratings were significantly related to the number of statements and words in the warnings ($r = .55$ and .47, $ps < .01$ and .05, respectively).

Prediction of Reading Warnings

Multiple regression analyses were used to determine the variables that would contribute to the prediction of willingness to read warnings. Because previous research (Godfrey et al., 1983; Godfrey & Laughery, 1984; Wogalter et al., 1986) has suggested that hazardousness and familiarity might be important factors in making the judgment to read warnings, regression models including these factors were considered first.

Younger adults. Hazardousness accounted for 41% of the variance of willingness to read warnings, $F(1, 20) = 16.06$, $p < .002$. With the inclusion of familiarity, the increment of 4.2% was not significant, $F(1, 19) = 1.47$, $p > .05$. Additional regression analyses showed that warning understandability and warning attractiveness each added significant unique variance to the model containing hazardousness ($ps < .0001$). When all three predictors were included the variance accounted for was substantial (96%), $F(3,$

18) = 148.47, $p < .0001$. No other variables (including the readability measures) significantly improved this prediction model.

Older adults. The hazardousness variable accounted for 25% of the variance of willingness to read the warnings, $F(1, 20) = 6.58$, $p < .02$. The addition of product familiarity did not significantly enhance prediction, $F(1, 19) < 1.0$. The addition of warning attractiveness to the model including hazardousness increased the prediction of reading warnings (by 33%), $F(1, 19) = 14.96$, $p < .001$. The addition of understandability significantly enhanced the model (by 24%), $F(1, 18) = 23.92$, $p < .0001$. No other individual variable added to the prediction of willingness to read. The regression model with hazardousness, warning attractiveness, and warning understandability accounted for 81.9% of the variance in willingness to read, $F(3, 18) = 27.19$, $p < .0001$. Therefore, the variables accounting for a significant amount of variance for willingness to read warnings were the same for both participant groups (i.e., hazardousness, warning understandability, and warning attractiveness).

Product Purchasing Intentions

Another purpose of this research was to determine the variables that would be related to pest-control product purchasing intentions (likelihood to purchase).

Younger adults. In general, a different set of variables was related to the likelihood of purchasing the products than was found for willingness to read warnings. The likelihood of purchasing was positively related to product familiarity, packaging attractiveness, and product strength, and it was negatively related to hazardousness, likelihood of being injured, and difficulty of use. Thus, only two variables in the set—hazardousness and injury likelihood—were significantly related to willingness to read warnings and purchasing intentions; however, these relationships were relatively small and in opposite directions. The simple correlation between willingness to read warnings and purchasing likelihood was not significant ($r = .04$, $p > .05$).

Older adults. The older adults' data, like that of the younger participants, showed positive relationships between purchasing intentions and product familiarity, packaging attractiveness, and product strength; however, unlike the data for the younger participants, the older adults' results showed no linear relationship between purchasing intentions with injury likelihood and difficulty of use. The simple correlation between willingness to read the warning and likelihood of purchasing the product was not significant ($r = .26$, $p > .05$).

Prediction of Purchase Intentions

Multiple regression analyses were used to determine the variables that would predict the likelihood of purchasing the products.

Younger adults. Product familiarity accounted for 91% of the variance of purchase intentions, $F(1, 20) = 191.21$, $p < .0001$. Product attractiveness added a small but significant increment of the variance accounted for, $F(1, 19) = 4.96$, $p < .04$. Adding a third predictor, difficulty of using the product, further enhanced the prediction, $F(1, 18) = 7.55$, $p < .02$. No other individual variable added significant variance to the model. The regression model with familiarity, product attractiveness, and difficulty of use accounted for 95% of the variance in willingness to purchase, $F(3, 18) = 107.45$, $p < .0001$.

Older adults. Product familiarity accounted for 74% of the variance of purchase intentions, $F(1, 20) = 55.65$, $p < .0001$. Product attractiveness added significant variance to the prediction, $F(1, 19) = 5.86$, $p < .03$. No other individual variable added significantly to the model. The regression model with familiarity and product attractiveness accounted for 80% of the variance in willingness to purchase, $F(2, 19) = 37.52$, $p < .0001$. Therefore, product familiarity and product attractiveness were significant predictors of purchasing intentions for both groups. However, unlike for the younger adults, difficulty of use was not a significant predictor of purchasing intentions for the older adults beyond that accounted for by familiarity and attractiveness.

Discussion

As expected, perceived hazardousness was the most important determinant of willingness to read warnings, corroborating the findings of Godfrey et al. (1983) and Wogalter et al. (1986). Earlier research (e.g., Godfrey & Laughery, 1984; Wright et al., 1982) has also suggested that reading warnings and instructions is related to product familiarity. Our results failed to find this relation, but they do support the results of Godfrey et al. (1983) and Wogalter et al. (1986), who found that willingness to read warnings was much more strongly predicted by hazard perception than by familiarity.

Two other variables—perceived understandability and attractiveness of warnings—were also positively related to participants' intentions to read warnings. This finding suggests that warning comprehensibility and appearance may be important factors in people's decision making and behavior with respect to warnings. Furthermore, it suggests that good warning design can serve as a means of motivating people to seek out hazard information.

Another measure of understandability, the readability of the warning text, was also assessed. Because most warning guidelines recommend that well-designed warnings should be concise and written for the reading level of the lowest ability user, we expected that people would be more willing to read shorter, lower grade-level warnings. Our results, however, indicated just the opposite. The correlations showed that people were more willing to read warnings that had text containing more statements and more difficult material. We can offer two possible reasons for this unexpected finding. First, this result might be due to the participant sample we used. The participants were taken from populations with higher reading levels than the general population, and our participants' reading level was likely to be higher than 10th grade (the average grade level of the warnings). Given this, it seems reasonable that our participants preferred reading material at higher rather than lower levels. The high level of ability was also probably a factor in failing to find differences between the two age groups. However, a second and more likely reason for the positive correlations between the readability measures and willingness to read warnings concerns their common relationship with a third variable: hazardousness. People may be more willing to read longer and more difficult warn-

ing text because such text is usually associated with more hazardous products. That is, hazardous products often need warnings that convey complex, less well-known precautionary information. This pattern of results appears similar to Laughery and Stanush's (1989) finding that people are more inclined to read warnings that provide explicit safety information. Because the data are correlational, the direction of causation is difficult to interpret. Certainly, it would not be unreasonable to expect that warnings containing greater information and written at higher grade levels serve to increase perceptions of hazardousness and thus affect people's willingness to read warnings on such products.

Virtually no evidence of a relationship between purchase intentions and reading warnings was noted. Purchase intentions were predicted by a different set of variables: product familiarity and package attractiveness. This result suggests that in order to increase consumers' purchase intentions, manufacturers should focus on increasing consumers' familiarity with their product (e.g., via advertising) and the attractiveness of the packaging. The relative independence of buying intentions and willingness to read warnings suggests that manufacturers can place appropriate and effective warnings on pest-control products and need not be concerned with lowering consumer buying intentions. Our results corroborate the conclusions suggested by Laughery and Stanush (1989) that good warnings have the positive effect of communicating appropriate hazard information, but that they have no negative effect on consumer buying intentions. Together, these findings should reduce manufacturers' fears that warnings on products would reduce sales. This conclusion, however, must be tempered by the fact that purchase intentions rather than actual purchase behaviors were studied. Further research is needed to examine the extent to which people actually read warnings when making purchase decisions, whether they read the warnings just prior to using the products, and whether they actually follow the precautionary behavior directed by the warnings. Research is also needed on individual differences, particularly with respect to demographics. Variables that would seem to be relevant include prior product use, socioeconomic status, geographic region, and parental status.

It should also be noted that the conclusions drawn from this study might be limited to the set of products we used. Whether the

relative independence of the warning-related variables and purchasing decisions holds for other kinds of products is an empirical question that needs further investigation. However, recent results by Laughery and Stanush (1989) suggest that our findings might also be generalizable to other categories of products.

Finally, some comment should be made regarding the implications of this work for product liability litigation. The courts have ruled that in order to prevent a product from being unreasonably dangerous, manufacturers or sellers need to provide directions or warnings to individuals who use potentially unsafe products or who might be endangered by their use (*Restatement of Torts, 2d,* 1965). In general, this means that all foreseeable purchasers, users, and others must be apprised of the full extent of the danger (e.g., *DeSantis v. Parker Feeder,* 1976). In case rulings, the courts have articulated several attributes of adequate warnings. Warnings should be understandable (*Lopez v. Aro,* 1979). They should communicate information that is not obvious to users (*Robinson v. Williamsen Idaho Equipment Company,* 1972), the severity of the danger (*Bituminous Casualty Corp v. Black & Decker Mfg. Co.,* 1974), the consequences if not adhered to (*Ford Motor Co. v. Nowak,* 1982), and the methods for avoiding the hazard (*Guidry v. Kem MFG Co.,* 1982). In addition, the adequacy of warnings may be judged on their conspicuousness (*Shell Oil Co. v. Gutierrez,* 1978), location (e.g., *Griggs v. Firestone Tire and Rubber Corp.,* 1975), and specificity (Commerce Clearing House, 1979). In general, the court may find the manufacturer to be negligent by failing to exercise reasonable care when a person behaving in a reasonable and prudent manner is injured with a product not having adequate warnings (*Restatement of Torts, 2d,* 1965).

Warnings research can be useful for product liability issues by determining the factors that influence hazard communication. This information can serve as input for litigation in several ways. For example, in situations in which warning issues surpass the "common knowledge" criterion used by the courts, warning-design experts can provide information to the judges and juries that would facilitate their understanding of warning issues and parameters. Warnings research can also play a role in the design of liability prevention programs prior to a product's marketing and during postsale monitoring. Clearly, warnings research has information to

offer to both the safety and legal domains. Future investigations will provide a more extensive data base concerning the factors that promote reliable and accurate hazard communication.

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