

in
y

RIGHT TO KNOW AND BEHAVIORAL RESPONSES
TO HAZARD WARNINGS*

W. Kip Viscusi* and Wesley A. Magat**

University of Chicago (Visiting) and Northwestern
University*, Fuqua School of Business, Duke University**

2

ABSTRACT

Survey data on consumer and worker responses to labels for hazardous products suggest that there are many rational aspects to economic behavior, particularly with respect to precautions. Nevertheless, there is evidence that consumers may overreact to low probability events. In addition, assessed risk perceptions appear to be quite sensitive to the framing of risk-related survey questions. The format in which the risk information is presented on labels is also instrumental.

KEY WORDS: labeling, right to know, framing, and information

1. INFORMATION AS A REGULATORY POLICY

In recent years labeling has become an increasingly popular regulatory approach to controlling the dangers from hazardous products. The Environmental Protection Agency (EPA) administers a long-standing program for labeling pesticide formulations, and the agency was given the power under the Toxic Substances Control Act (TOSCA) to use labels as a mechanism for controlling the hazards from other toxic chemicals. The Food and Drug Administration (FDA) sets labeling requirements for the ingredients of food and drug products. The Occupational Safety and Health Administration (OSHA) recently promulgated an extensive and costly chemical labeling program to protect workers. The Federal Trade Commission (FTC) has promulgated labeling regulations for products such as home insulation, textile wearing apparel, and used automobiles. The Consumer Product Safety Commission (CPSC) included labeling requirements in its lawnmower and CB antenna rules.

In addition, many states and cities have also launched initiatives in this general area. Most of these policies are directed at hazards arising in the workplace. In some instances, the risks involved affect the community at large. In these instances, the need to inform consumers of the risks so that they can take appropriate action hinges on the type of concerns explored in our consumer information survey.

Particularly for chemical hazards and other health risks, the general heading under which these policies have been placed is the "right to know" designation. Although this phraseology has popular appeal, we will not

delve into the issue of whether individuals have or should be given the right to know the risks to which they are exposed. We will, however, address whether it is efficient for individuals to have this information, and we will investigate the efficiency gains that are achievable under these right-to-know policies. For concreteness, we will discuss chemical labeling efforts, since they are the target of much of the right-to-know movement and the focus of our research.

Relative to other regulatory alternatives for controlling hazardous chemicals, labels possess two strong advantages. First, they allow chemical users with different preferences towards risk, different needs for the products, and different usage rates to select the combination of risk, product efficacy, and usage rates that is best for each of them. If individuals are "fully rational," giving them more information will only enhance their welfare. They can choose to leave their actions unaltered, or they can modify their actions in the presence of the new information if that is desirable. The principal exception to this welfare-enhancing property of information is that added information about risks that we cannot alter may create anxiety and welfare losses that outweigh the value of information for decision-making. In the usual case, however, more information is preferable to less. This property no doubt has contributed to the widespread advocacy of right-to-know policies by consumer groups.

The choice in governmental contexts is usually different since there the principal policy alternatives to inaction are informational policies or more direct, choice-limiting alternatives, such as restricting the uses of the chemical. The flexibility of informational policies differs from that of the standard-setting approach, which forces every consumer to face the same level of risk. The labeling alternative is more consistent with freedom of individual choice than standards or other policies dictated by a regulatory agency.

Notwithstanding the many appealing aspects of labels, little is known about their effectiveness in altering precautionary behavior. To increase our knowledge of the properties of labels we undertook surveys of consumer and worker responses to labels that we will review briefly here.

2. FRAMING AND FORMAT EFFECTS

Framing Risk Issues

Ideally, one would like to inform consumers that with no precautions they will face some additional probability X of injury from product usage and that with precautions they will lower the risk to some value Y . They can use this information to decide whether or not to buy the product and, if they purchase it, which precautions to take.

Presenting risk information in such a straightforward manner is unlikely to be effective, however. Most fundamentally, the true risks are not well understood. Not all injuries are reported to poison control centers or to other government agencies, and information on the frequency of use of different products is not easy to obtain. For chemical hazards of a long-term nature, there may also be fundamental shortcomings in our knowledge of the properties of different chemical exposures. Even if the government agency understood the overall average risk, the user-specific risk would not be known. Individuals differ both in terms of the effectiveness of their precautionary actions and in their susceptibility

to different exposures. Young children, for example, are often likely to face a greater cancer risk from a given level of carcinogenic exposure than are adults.

A second barrier to presenting probabilistic risk information is that evidence such as that in Kunreuther et al. (1978) suggests that individuals have difficulty processing risk information of that type, particularly regarding low probability events. The difficulties that arise can be illustrated with respect to seemingly modest changes in questions designed to elicit individuals' risk assessments.

In Viscusi and O'Connor (1984) the authors elicited workers' risk assessments for their current jobs and for jobs altered by the introduction of a new chemical. The technique used was to present respondents with a linear scale from very safe to very dangerous, with an arrow that marked the riskiness of the average U.S. private sector injury and illness rate. Workers then assessed the risk of their jobs by marking on the scale their current job's risk.

The responses appeared to be generally reasonable. Workers assessed their job risks as being almost twice as large as the published accident rate for the chemical industry, which tends to exclude chemical risks and captures primarily accidents. As a result, the survey responses are quite plausible in view of the notorious under-reporting of the chemical hazards associated with such positions. What was most striking were the risk assessments for the subsample of workers who were told that the chemicals with which they now worked would be replaced by sodium carbonate, thus eliminating the chemical-induced risk of their jobs. For this group the average risk assessment was identically equal to the published accident rate for the chemical industry, which should be expected since the BLS statistics primarily reflect such non-chemical hazards.

Far less reassuring results were obtained in the study by Viscusi and Magat (forthcoming) of consumers' risk perceptions for bleach and drain opener. To ascertain the value of individuals' risk assessments for the four injuries in this study, we asked respondents to scale particular risks relative to those faced by an average household. This procedure was adopted because of the very low level of the annual risks -- on the order of one accident per 50,000 households, or one accident per 150,000 people. An alternative procedure that we considered was to present respondents with a linear risk scale, but this was not feasible because of the small level of the risk involved and the difficulty in finding meaningful reference points. The procedure we selected instead was to inform consumers of the true average risk and then to ask them whether or not they believed they faced above average risk, below average risk, or the same risk as the average.

The results in Table 1 are quite striking. In all cases very few consumers -- about 3 percent or less -- consider their households to be above average in risk. Roughly half of all households consider themselves to be about average in riskiness, and the other half consider themselves to be below average in risk. It is noteworthy that the major outlier in terms of risk perceptions is child poisonings from drain openers, as 65 percent of all households view themselves as being below average in this risk. This is by far the most severe risk in the sample, as burns to the throat may cause the permanent loss of use of the child's esophagus. Consumers appear to be particularly optimistic that this very adverse event will not occur.

Table 1

Relative Risk Assessment

	<u>Distribution of Relative Risk Ranges</u>		
	<u>Above Average</u>	<u>Average</u>	<u>Below Average</u>
<u>Drain Opener Risks</u>			
Hand Burn	0.03	0.46	0.51
Child Poisoning	0.03	0.32	0.65
<u>Cleaning Agent Risks</u>			
Chloramine Gas	0.03	0.50	0.46
Child Poisoning	0.02	0.57	0.40

The high degree of optimism among consumers is not unprecedented in studies of risk perception. Interviews on automobile driving behavior by Svenson (1970) suggest that most drivers view themselves as being among the most skillful and safe drivers in the population. Similarly, a study of consumer risks by Rethans (1979) found that 97 percent of all consumers believe that they were either average or above average in their ability to avoid accidents from bicycles and power mowers. This high fraction of people who believe that they are relatively safe suggests that there may be some overoptimism in individuals' risk perception when these questions are asked in relative terms.

The framing of these risk assessment questions appears to be of fundamental importance. For the chemical worker results discussed above, which utilized a linear scale, the responses were more reasonable. Other researchers have also not observed a pattern in which risks are all underassessed. Lichtenstein et al. (1978) have found that individuals overassess small mortality risks and underassess large mortality risks -- a result that is shown in Viscusi (1984) to be consistent with a rational Bayesian learning process. These studies did not find systematic overoptimism in risk perceptions. As a result, the risk perceptions that actually drive individual behavior may not necessarily be biased, but when asked to make relative risk judgments, it may be that consumers do have an overoptimistic perception of their own relative ability to avoid the risk.

A simple modification in the manner in which risk perception questions are asked consequently produces widely varying results. These findings suggest that the success of efforts to provide risk information is likely to be quite sensitive to the manner of information transfer. One cannot simply provide information and ensure that it will be processed reliably and acted upon. The manner of information provision will greatly affect what the ultimate impact of the information will be on individual welfare.

These concerns suggest that many of the policies that include, for example, detailed lists of chemical contents may not be successful. What is needed is the provision of risk information that can be understood by consumers and workers and which can be used in a reliable fashion to promote better decisions.

Format Effects

One important dimension of information transfer is the format in which the information is provided. The importance of format arises in other contexts as well, such as in the energy audit analysis of Magat, Payne, and Brucato (1984). In our consumer labeling study, we examined the effects of different labeling formats on the precautionary actions of a group of 368 consumers interviewed at a mall intercept in Greensboro, North Carolina.

In the case of both bleach and drain opener, a label purged of risk information was included to assess the effect of the absence of hazard warnings on behavior. For each product we also included more than one format for which risk information was provided to ascertain the effect of information format on risk-averting behavior.

For the bleach, three different formats were examined. The first format was patterned after the current Clorox label. The second format used was based on the Kroger brand of bleach, called Bright, which organizes the risk information in what we believed to be a more effective manner. Finally, we included what we called the Test label developed in cooperation with our colleagues James Bettman, John Payne, and Richard Staelin. This label organized information on the nature of the risk and the appropriate precautions in a systematic fashion and featured it prominently on the label.

A similar approach was used in the case of drain opener, except in that instance we used only one existing label to augment the No Warning and Test label experimental treatments. The market-based label was patterned after the Drano and Red Devil Lye labels, which featured the risk information quite prominently.

The results obtained suggest that information and the format in which it is presented are consequential. In all cases involving the bleach label, the Test label performs best in terms of inducing consumers to take precautions to avoid the key hazards. The danger of mixing the cleaning agent with either toilet bowl cleaner or ammonia-based cleaners is that chloramine gas will form. This toxic gas is a leading cause of poisonings among adults. In the absence of a hazard warning, 17 percent of all respondents would take this precaution. The Clorox and Bright labels have a modest effect on the toilet bowl mixing behavior, increasing the proportion of consumers taking precautions to 23 and 32, respectively, and the Test label more than doubles the proportion of subjects who would undertake this precaution, increasing it to 40.

The likelihood of storage in a childproof location is enhanced in all cases by the label, with the Test label being most effective as it increases the childproof storage propensity by 33 percent. The Bright label was least effective, raising the storage propensity by only 8 percent. On average, the Test label creates an awareness of the key risks among over one-tenth of the population that would not otherwise have been reached with existing labels.

In the case of drain openers, there was also evidence of differential performance of the labels, but in this case the Test label did not perform as well as the label on the existing product (Drano). The risks of drain opener appear to be well-known to consumers even in the absence of a warning on the label. The majority of the subjects (63 percent) would wear gloves even in the absence of the warning and would also store the product in a childproof location (57 percent). The Drano label increases

the propensity to undertake such precautions by 19 percent in the case of wearing rubber gloves and by 11 percent in the case of storage in a childproof location. In contrast, the Test label has roughly half this effectiveness.

The general spirit of these results is also borne out in more sophisticated statistical analyses that distinguish the effect of labels per se from the role of personal characteristics, such as education. Format effects are clearly of consequence. Labeling policies, such as OSHA's, that leave the choice of the format to the firm's discretion, may not fully exploit the advantages from providing formatting guidelines for effective labels.

3. VALUING THE HEALTH EFFECTS

Research such as that discussed above can be used to ascertain how the frequency of precaution-taking will increase in the presence of risk information. Much more problematic is ascertaining the willingness to pay to avoid these injuries. In an effort to assess their magnitude we used two techniques. For the first of these, contingent valuation (see Cummings, Brookshire, and Schultze [1984] for a review), we asked consumers how much they would be willing to pay per bottle of bleach or drain opener to reduce various risks by a small amount. The second approach, conjoint analysis (see Green and Srinivasan [1978] for a review), used a series of price-risk combinations to elicit the magnitude of this trade-off.

The amount consumers would be willing to pay to reduce the injury rate by one for every 2 million household users is substantial. In the case of contingent valuation, the willingness to pay per bottle is \$.15 for chloramine gassings, \$.27 for child poisoning from bleach, \$.06 for hand burns from drain opener, and \$.18 for child poisoning from drain opener. The conjoint analysis responses are consistently greater -- up to ten times as large for drain opener hand burns.

Because of the low level of the probabilities involved, even a small additional willingness to pay per container for a safer product translates into a large valuation. For example, the implied value of a hand burn from drain opener is \$120,000.

In all likelihood, these findings provide an excessive measure of individuals' actual valuation of the health outcomes. In particular, the values appear high relative to estimated values for mortality risks. We do, however, believe that the survey results, although perhaps irrational, accurately reflect how individuals will react to low probability events. Whether these numbers should be used in a benefit-cost analysis is more questionable.

The high valuation numbers do, however, suggest that individuals may overreact to low-probability events. The individuals have difficulty with small probabilities is not a novel result. What is intriguing is that there is often an overreaction in terms of the risk-dollar trade-offs implied by individual behavior. The limitations to rationality in this instance are systematic and in a common direction.

4. CONCLUSION

Rather than approaching informational policies in terms of whether individuals have a right to know, we have asked the somewhat different

question of whether it is efficient for them to know. The typical labeling policies urge consumers to undertake particular precautions, but they may not heed these warnings and when they do there is an offsetting disutility of precautions. In this instance it is particularly important to assess whether, on balance, increased precautionary behavior is desirable.

Overall, the task of conveying risk information is by no means straightforward. Seemingly minor changes in the manner in which the information is presented can have a substantial influence on its ultimate effect. Although informational strategies have many attractive features, notably their flexibility with respect to individual differences in the desirable level of precautions, they are also fraught with difficulties. Additional research on the design of information transfer mechanisms will enhance the effectiveness of these policies and allow us to better assess the net benefits of information provision as a regulatory alternative.

REFERENCES

- Cummings, Ronald G., David S. Brookshire, and William D. Schultze, 1984, "Valuing Environmental Goods: A State of the Art Assessment of the Contingent Valuation Method," Draft Report to the U.S. Environmental Protection Agency.
- Green, Paul E., and V. Srinivasan, 1978, "Conjoint Analysis in Consumer Research: Issues and Outlook," Journal of Consumer Research, Vol. 5 (September), pp. 103-123.
- Kunreuther, Howard, et al., 1978, Disaster Insurance Protection: Public Policy Lessons, New York: Wiley-Interscience.
- Lichtenstein, S., P. Slovic, B. Fischhoff, M. Layman, and B. Combs, 1978, "Judged Frequency of Lethal Events," Journal of Experimental Psychology, Vol. 4, pp. 551-578.
- Magat, Wesley, John Payne, and Peter Brucato, 1984, "Information Provision as a Regulatory Alternative: The Case of Residential Energy Conservation," Working Paper, Duke University Center for Study of Business Regulation.
- Rethans, A., 1979, An Investigation of Consumer Perceptions of Product Hazards, University of Oregon doctoral dissertation.
- Svenson, O., 1981, "Are We All Less Risky and more Skillful than Our Fellow Drivers?" Acta Psychologica, Vol. 47, pp. 143-148.
- Viscusi, W. Kip, 1985, "A Bayesian Perspective on Biases in Risk Perception," Economics Letters, Vol. 17, pp. 59-62.
- Viscusi, W. Kip, and Wesley Magat, forthcoming, Learning about Risk: Economic Responses to Risk Information, Cambridge: Harvard University Press.
- Viscusi, W. Kip, and Charles O'Connor, 1984, "Adaptive Responses to Chemical Labeling: Are Workers Bayesian Decision Makers?" The American Economic Review, Vol. 74, No. 5 (December), pp. 942-956.