

Comparison Between Perceptions of Farm Hazards and Injury Records in Iowa

C. V. Schwab, A. R. Ralston, L. J. Miller, H. M. Hanna

Abstract

The ways that Iowa farm operators and extension educators perceive potential hazards in agricultural operations significantly affects the potential for behavioral change. Data gathered through separate surveys of farm operators and extension educators in Iowa were compared with agricultural injury and fatality data collected by the Iowa Department of Public Health's SPRAINS project. Statewide results indicated that educators' and operators' perceptions about farm dangers did not correspond to each other and their perceptions did not correspond to the injury records. Results indicated that although many educators and operators in some regions of the state have similar perceptions about farm dangers, their perceptions do not agree with actual injury records. The analysis provides insight into the management of future efforts to promote safety education and to bring about behavioral changes that can reduce risks.

Keywords. Safety, Extension program, Survey, Prevention.

Individual perceptions affect a person's actions, behavior, and interest. Perception is developed through a complex assimilation of the everyday environment and the integration of thought processes. A person's perception of risk is continually updated to respond to the content and the form of risk-related information (Smith and Desvousges, 1988). A person uses heuristics to organize the barrage of information on which they base actions. The accuracy and development of those perceptions of risk and their effects on safety issues are considered in this article.

Accuracy of Perceptions

People do not always perceive risk accurately. Overend (1985) determined that the public perception of highway safety failed to correspond with reality. Only one in four drivers polled knew the probability of being involved in a traffic accident. Not only did three-quarters of the participants fail to perceive the correct probability, but the 42% who responded with a wrong probability under-estimated the actual risk by an average of 70 times.

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The authors are Charles V. Schwab, *ASAE Member Engineer*, Associate Professor, Agricultural & Biosystems Engineering Dept.; August R. Ralston, Professor, Finance Dept.; Laura J. Miller, Communication Specialist, and H. Mark Hanna, *ASAE Member Engineer*, Extension Agricultural Engineer in the Agricultural & Biosystems Engineering Dept., Iowa State University, Ames. Corresponding author: Charles V. Schwab, Agricultural & Biosystems Engineering Dept., 206A Davidson, Iowa State University, Ames, IA 50011; e-mail <cvschwab@iastate.edu>.

Misperceptions of danger (or a less-than accurate perception of risk) are exemplified by records of accidents on highway railway grade crossings (Overend, 1985). Beliefs such as "the train can stop", or "you can beat a train across the crossing" have resulted in numerous injuries and deaths.

In an agricultural work environment, common misperceptions may contribute to serious injuries. People can become entangled in farm machinery at rates from 2 m/s for a power take-off (PTO) shaft rotating 540 rpm to 20 m/s for belts and pulley systems in a combine at operating speeds. During the typical reaction time of 0.75 s, a person would be pulled at least 1.5 m into the machinery. The belief that machinery operators think they can release the corn stalk before becoming entangled can contribute to the entanglement that result in disabling injuries.

Three common misperceptions apply to safe behavior, presented by Aherin and Murphy (1987). First, people tend to overestimate dangers attributed to infrequent causes of death and underestimate those of frequent causes. A classic example is the perceived high risk of premature death to people exposed to electromagnetic fields, yet failure to acknowledge the high risk of death from agricultural machinery. Second, people tend to consider dramatic or sensationalized deaths as a greater risk than unspectacular deaths. A tragedy such as an airline crash in which dozens of people are killed and injured receives prime coverage by national news organizations, yet news organizations routinely ignore a large number of deaths and injuries resulting from slips and falls around the farmstead. Third, people tend to minimize risks if they have control over a situation, and maximize risks when an event is out of their control. Ninety percent of the participants in a highway safety survey conducted by Overend (1985) said that if they were in an accident, the cause would not be their error. This finding illustrates that hazards under the automobile operator's control were perceived as minimal and shifted to those hazards beyond the operator's control. These three types of misperceptions regarding risk encourage action based on exaggerated or untrue beliefs.

Development of Perceptions

The way in which risk is perceived and assessed is a perplexing and complex process. For example, Nelkin (1989) states that professionals who determine risk usually disagree over the significance of the risk, the adequacy of evidence, methodologies for evaluating and measuring risk, severity of health effects, and appropriate standards to guide regulations. Thus, a lay person will have difficulty in developing a realistic perception of danger.

Current misperceptions also inhibit the ability to change or modify an inaccurate perception of risk. Covello et al. (1986) determined four factors that influence effective public communication about risk: (1) uncertainties and limits of scientific understanding, (2) source of information and its credibility, (3) communication channel used (print, radio, or television), and (4) problems that result from the biases, beliefs, and perceptions of individuals targeted for the information.

The media decide how to deliver facts about the environment and, therefore, affect individual perceptions of risks (Covello, 1992). Development of perceptions will include biases inherent in the news coverage. For example, information pertaining to safety may be "newsworthy" for several reasons: as a report of a tragedy, human interest or drama, or as a report of research findings with unexpected or shocking findings concerning health and safety. This treatment of perception-forming information will be expressed with greater intensity than will mundane facts of everyday occurrence. As an example, tremendous media coverage was devoted to the injury of the North Dakota boy who lost both arms in a PTO entanglement

(Davis, 1992; "The Tulsa World", 1992). The media focused primarily on the heroic way in which he managed to summon help. Details with a more accurate set of facts upon which to base perceptions of farm work hazards were absent. The serious consequences of this absence were illustrated several weeks later when another boy was injured in a similar situations. The second victim said he remembered media accounts of the North Dakota boy's attempts to get help ("The Houston Chronicle", 1992), but he had not learned how to avoid a similar situation.

Effect of Perceptions on Safety Issues

Perceptions are key to the development of effective educational programs to reduce the rate of agricultural injuries. Educators set priorities based on their perceptions, but often those perceptions are incorrect, resulting in safety programs that may not address the most prevalent reported injuries and which may not allocate precious resource of time to develop safety programs. Several contemporary and emerging theories of behavioral psychology also incorporate some form of perception about safety issues Aherin et al. (1990).

The objective of this article was to compare the perception of extension educators and farm operators with actual injury data. The effectiveness of educational programs and safety training efforts can be increased by highlighting differences between those perceptions of danger and reported injuries in a geographic region.

Methods

In this section, data collection methods are described and survey results are compared with injury records. Information about perceptions was gathered from surveys of Iowa farm operators and county-level staff at Iowa State University Extension. The methodology for the surveys and the method of collecting injury records are described.

Farm Operator's Survey

A telephone survey of farm operators in Iowa was conducted by the Agricultural Health Promotion Systems (AHPS) project at Iowa State University. Approximately 30 min were required to complete each survey in Nov. and Dec. 1990. According to a random selection method, an initial sample size of 1639 potential respondents were selected from rural directories published by Farm and Home Publishers, Ltd. From the first 1390 of these households, 584 met the screening criteria of (1) being a farm operator, (2) having 40 acres of cropland or raising livestock for sale, and (3) intending to farm in both 1991 and 1992. Interviewing ended without contacting the remaining 249 households. A response rate of 89% for the survey was obtained with 584 eligible households, 66 refused to participate, and one judged not competent. The screening process yielded 517 usable questionnaires. Included in the survey was an open-ended question: "Of all the types of hazards and dangers on a farm, which one do you think is the most threatening to farmers and their families?". The results were coded according to counties and regions as defined by the seven area extension boundaries in Iowa.

Extension Educator's Survey

Iowa State University Extension field staff were introduced to the Agricultural Health Promotion Systems (AHPS) program during the first year of the program in 1990. The initial orientation included a survey of staff, a brief video presentation

that explained project goals and methods, and a question-and-answer session. The survey was completed before the introductory presentation.

The survey contained six questions about their perceptions of agricultural occupational safety and health. One question asked educators to list as many as five hazards to the safety or health of farm workers and families in their area. Respondents were asked to be specific and list threats in order of importance; only the first threat was used in analysis. Responses were tabulated by county and region as defined by the seven area extension boundaries in Iowa.

Iowa extension field staff are located in 100 county offices (one of the state's 99 counties has two offices) and seven area offices. Each area office contains a group of specialists who respond to requests from counties within their region. Each area includes 9 to 17 counties.

Injury Records

The Sentinel Project Researching Agricultural Injury Notification Systems (SPRAINS) is operated by the Division of Disease Prevention of the Iowa Department of Public Health. Its purpose is to track acute injuries ranging from fatalities to minor injuries that are related to agriculture in Iowa (Currier et al., 1990a). The injury records were obtained from the annual report of Currier et al., 1990b.

The program uses an active/passive surveillance system to collect injury records. The SPRAINS staff actively checks 125 hospitals and 75 sentinel medical clinics for agricultural injury data and investigates fatalities. Other medical clinics voluntarily report injuries, but no follow-ups are conducted by SPRAINS staff. This system encompasses the state.

Hospitals in this program range in size from fewer than 49 acute beds to more than 400 acute beds, and are located in 91 of 99 counties. Sentinel sites include medical offices with between one and six physicians. In addition, the Iowa Bureau of Vital Statistics and Medical Examiners is requested to report any deaths resulting from agricultural injuries to SPRAINS.

Results

Information collected from surveys of extension educators and farm operators, and injury records was sorted into eight categories according to cause of injury. The following eight categories were based on classification of injury data reported and survey responses: machinery and equipment, agricultural chemicals, confinement air quality, farmstead hazards, tractor rollover, animals, stress, and managing safety. The "confinement air quality" category included respiratory hazards from breathing dust, toxic gases, and other health hazards. "Farmstead hazards" included fixed farm structures and injuries related to them, such as slips and falls. "Stress" contained injuries resulting from the emotional condition of farm operators, such as concerns about the bank loan or weather, and injuries often were self-inflicted. "Managing safety" injuries were caused by lack of safety training or education, such as strained back from improper lifting techniques. Injuries in the "Tractor rollovers", "Animals", and "Machinery and equipment" categories are implied in the category name. Each survey response and each injury could be listed under one of the eight headings. This step provided uniformity between different data sets, which was needed to make comparisons. In the extension educator survey, a variety of responses was given, however, all could be classified into one of the eight categories.

Statewide totals for each group are presented in table 1. Generally, all three groups identified machinery and equipment as the top hazard. After the first item, the three groups began to differ in their ranking of the hazards. A larger distribution of responses by extension educators was in the "managing safety" category, and a majority were concerned about safety training for youth.

The top hazard perceived by farm operators varied between "machinery and equipment" and "agricultural chemicals". As in state totals, farm operators did not perceive injuries classified in the "managing safety" category as being as much of a threat as did extension educators. The actual number of animal injuries exceeded the concern expressed by both farm operators and extension educators. Percentages of the total number of responses for each of the eight categories were used to determine the ranking for each category for the different groups.

The comparison between the rankings of the dangers and hazards in agriculture was accomplished by using the Spearman's Coefficient of Rank Correlation defined by Steel and Torrie (1989). This procedure measures the correspondence between ranks of different data sets. The Spearman's coefficient is denoted by R_s and is bounded by the values -1 and 1. The rankings of extension educators and the farm operators, extension educators and injury records, and farm operators and injury records were compared to determine if similarities of perceptions exist between groups. Actual injury data is assumed to represent a close approximation to reality. Comparisons also determined if educators and learners have similar perceptions of the dangers associated with agricultural production in Iowa.

Statewide Rankings

The Spearman's Coefficient of Rank Correlation indicated that the statewide ranking for farm operators compared to extension educators was not significantly similar at the 0.10 level with an R_s value of 0.6012. There were obvious differences in how farm operators and extension educators perceived farm dangers, compared to actual injury records. "Machinery and equipment" composed the largest number of the injuries recorded in Iowa. Two other major causes were "animals" and "farmstead hazards". The Spearman's Coefficient of Rank Correlation was low, ranging from 0.1905 to 0.6012 for extension educators compared to injury records, and for farm operators compared to injury records.

Table 1. Statewide distribution for the most hazardous threat to safety and health of farm workers and families as perceived by extension educators, farm operators, and injury records

Category	Response					
	Extension Educators		Farm Operators		Injury Records	
	(%)	(n)	(%)	(n)	(%)	(n)
Machinery and equipment	28	65	40	207	57	1234
Agricultural chemicals	26	60	40	207	2	43
Confinement air quality	12	28	13	67	1	22
Farmstead hazards	8	19	4	21	17	368
Tractor rollover	4	9	0	0	2	43
Animals	0	0	2	10	17	368
Stress	0	0	1	5	1	22
Managing safety	22	51	0	0	3	65
Totals	100	232	100	517	100	2165

Regional Rankings

Table 2 presents the Spearman's Coefficient of Rank Correlation for different comparisons by various geographical regions. The geographic regions were divided along extension's seven administrative boundaries. Each extension region contains unique staff and individualized farm safety agendas. The coefficient of rank correlation for all seven regions was low for educator perceptions compared to actual injury records. No region was significantly similar at the 0.10 level, using a t-test with six degrees of freedom.

The operators' perception of farm danger compared to actual injury records also had a low coefficient of rank correlation. Spearman's Coefficient of Rank Correlation values ranged between -0.0179 and 0.7024. Regions 1 through 5 and region 7 did not have any significant similarity at the 0.10 level when using the t-test with six degrees of freedom. Farm operator responses in region 6, however, were significantly similar to injury records.

Educators and farm operators had several statistically similar perceptions of farm dangers. This comparison of perceptions had higher values in the Spearman's Coefficient of Rank Correlation, ranging from 0.1012 to 0.8095. Three regions (2, 3, and 4) were significantly similar at the 0.10 level for the t-test, indicating that both educators and operators ranked farm dangers in much the same way.

A third test was performed to determine if regional injury records were uniform throughout the state, that is, that each region had approximately the same rank order of categories. Typically, different areas of agricultural production are associated with different types of dangers. In dairy production, there exists more contact time with animals and, therefore, the rate of animal-related injuries could be proportionally higher than in crop production. Certain regions within Iowa have higher concentrations of dairy industry than others, and, therefore, a shift in the ranking of the perceived dangers would be expected. Results indicate that all regions have a similar ranking of categories. The t-test was not significant at the 0.10 level. Year after year, the top three injury categories for Iowa are "equipment and machinery", "animals", and "slips and falls" (Currier et al., 1990, 1991, 1992).

Table 2. Spearman's correlation coefficient for the ranking of the eight categories based on the percentage of response by the extension educators, and farm operator relationship between the injury records and the correlation between the extension educators and farm operators

Region	Extension Educators/ Injury Records			Farm Operators/ Injury Records			Educators/Operators		
	R _s	t	P>0.10	R _s	t	P>0.10	R _s	t	P>0.10
1	-0.0179	-0.043	no	0.3095	0.797	no	0.5774	1.732	no
2	0.3571	0.936	no	0.1607	0.398	no	0.8095	3.377	yes
3	0.5774	1.732	no	0.3333	0.866	no	0.6369	2.023	yes
4	0.0774	0.190	no	0.0833	0.204	no	0.6667	2.190	yes
5	0.1667	0.414	no	0.4286	1.161	no	0.4524	1.242	no
6	0.3155	0.814	no	0.7024	2.417	yes	0.5774	1.732	no
7	-0.0893	-0.219	no	0.1012	0.249	no	0.1012	0.249	no
State Totals	0.2321	0.584	no	0.1905	0.475	no	0.6012	1.842	no

R_s - Spearman's correlation coefficient of ranking (range of -1 < R_s < 1).

t - Student's t value with six degrees of freedom.

P > 0.10 - Indication that no significant difference exists between the groups at the 0.10 level.

Discussion and Conclusions

Awareness is a key ingredient in safety. Overlooking or failing to take precautions in a dangerous situation can lead to a fatal injury. Likewise, a certain level of awareness is necessary for the development and success of safety programs. Unless an extension educator is convinced that a threat is serious, why would a topic be included in a safety program? Unless attendance is required, why would people attend a safety program on a topic they do not perceive to be important in their daily activities? For example, the large number of animal injuries reported on Iowa farms could justify an extensive livestock safety program: 17% of all injuries are related to animals. On the other hand, less than 2% of Iowa farm operators and extension educators perceived animals to be a serious threat. Their misperceptions could result in fewer programs, and poor attendance at programs that are offered on animal safety.

Educational programs based on injury data and targeted to reduce the number of injuries must be preceded by efforts to increase awareness and modify perceptions. Such efforts may help motivate both educators, who must allocate time to plan safety programs, and farm operators, who must make the effort to attend safety programs. Adoption of suggested safety practices also might be higher when both educators and audiences have been sensitized to the need for such programs.

The study shows another misperception regarding agricultural chemicals. Extension educators and farm operators consider agricultural chemicals to be the second most serious hazard but injury records placed it lower, tying for fifth place among eight. This misperception could be the result of federal regulations that mandate safety training and certification for application of agricultural chemicals, which had been offered by extension educators several years prior to the survey. Injury records also monitor only acute injuries, not chronic injuries that may be the result of handling chemicals.

In several regions, perceptions of extension educators nearly matched perceptions of their audiences, farm operators. This finding seems reasonable because extension educators often have related backgrounds and experiences as farm operators. Many extension educators live in the community where they work, and may farm part-time. This finding also could indicate that the client-driven extension service has correctly identified the needs and is responding to requests of its clients, farm operators. These needs and requests, however, may be based on inaccurate perception of real needs, which is the most important finding of this study.

The conclusions are:

- Farm operators and extension educators generally have similar perceptions of agricultural hazards.
- Extension educators' ranking of perceptions of agricultural hazards do not correspond with injury records.
- Farm operators' ranking of perceptions of agricultural hazards do not correspond with injury records.

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