# Development of the Farm Safety and Health Beliefs Scale

C. J. Hodne,  K. Thu,  K. J. Donham,  D. Watson,  N. Roy

## Abstract

Farmers' safety and health beliefs are measured by the new 24-item Farm Safety and Health Beliefs Scale (FSHBS), derived from the Health Belief Model (HBM) and tested among Iowa farmers ($\underline{n}$ = 259) involved in the Certified Safe Farms (CSF) project. A factor analysis of responses to 39 original FSHBS items revealed five HBM-related factors: (1) susceptibility to a farm-related accident/illness; (2) benefits of performing safety and health behaviors; (3) barriers to performing these behaviors; (4) self-efficacy regarding performing these behaviors; and (5) severity/finances regarding the consequences of an accident/illness. Farmers who feel more able to perform behaviors that promote their overall health report greater abilities and benefits in practicing proper farm safety and health behaviors. These farmers also feel less vulnerable to farm-related accidents and illnesses. Limitations are discussed, along with implications for educational and clinical interventions.

*Keywords.* **Attitudes, Measurement instrument, Farm safety, Health beliefs.**

Farming consistently ranks among the top three most hazardous occupations with high rates of mortality, injuries, and health problems (Popendorf and Donham, 1991; Zwerling et al., 1995). The fatality rate for agriculture in 1994 was 26/100,000 workers, compared to 4/100,000 for all other industries combined (National Safety Council, 1995). Approximately 200,000 work-related injuries occurred on U.S. farms in 1993; about two-thirds of these injuries were to farm operators and family members (U. S. Department of Agriculture, 1994). State-wide incidence is exemplified by Iowa's total of 13,946 farm injuries and 454 farm-related deaths between 1990 and 1996 (Goudy et al., 1997).

Farmers work with dangerous machinery, agrichemicals, and livestock in difficult environments including bad weather, noise, dust, and other stressors. Added to these everyday work hazards are those generated by the increasing industrialization of family farm production: larger machinery, increased land and capital intensiveness,

greater use of agrichemicals, concentrated livestock production, and fewer farmers (Krebs, 1992).

Farmers' workplace stressors are compounded by omnipresent financial stressors caused by the political and economic power of agribusiness monopolies to demand low raw material prices, resulting in low net incomes and high debt loads for farmers (Krebs, 1992). Farmers' stress from low farm prices, monopolized markets, and problems with cash flow and loan repayments (Elkind and Cody-Salter, 1994; Kettner et al., 1988; Walker et al., 1986) is linked to family dysfunction, rural community decline, and other social problems (Conger and Elder, 1994).

The industrialization of farm production and associated socio-economic conditions affect farmers' workplace and their safety and health (Donham and Thu, 1993; Thu, 1998) and influence farmers' related beliefs (Scharf et al., 1998). For example, dairy farmers have parallel concerns about pesticide usage and cancer risks (Perry and Bloom, 1998). In addition, farmers' beliefs that stress affects their safety and health (Kidd et al., 1996; Thu, 1998) coincide with evidence of links between stress and farm injuries (Geller et al., 1990; Thu et al., 1997).

The social and physical context of the farm workplace is considered in various interventions—epidemiology, education, clinical practice, and policy making—to improve farmers' safety and health (Donham et al., 1990; Merchant et al., 1995; National Coalition for Agricultural Safety and Health, 1989). Many interventions focus on relationships between farmers' beliefs about their safety and health and associated protective behaviors (e.g., use of personal protective equipment). Therefore, a theoretically based description of farmers' safety and health beliefs may help clarify the theoretical and applied focus of interventions, while sharpening the debate about the extent to which educational interventions may lead to reduced injuries and illnesses among farmers (Elkind, 1991; Murphy, 1981; Rodriquez et al., 1997).

## The Health Belief Model

The Health Belief Model (Hochbaum, 1958; Rosenstock, 1974ab) is widely used to predict participation in health screenings, immunizations, adoption of health and safety behaviors, and adherence to medical and self-care regimens (for reviews, Harrison et al., 1992; Janz and Becker, 1984). Interventions and research based on the Health Belief Model (HBM) have tended to focus on four constructs, Susceptibility, Severity, Benefits, and Barriers, regarding an individual's subjective perceptions (Rosenstock, 1990). *Susceptibility* refers to a person's sense of risk or likelihood that they may experience a health problem or accident. *Severity* involves the negative consequences of a health problem or accident (e.g., disability, pain). *Benefits* refers to beliefs about the effectiveness of a behavior in reducing the threat of a health condition. *Barriers* are impediments to performing a health behavior, including evaluations of the negative aspects of the behavior, such as costs (e.g., money, time), side effects or unpleasantness.

According to the HBM, an individual's perceived susceptibility to a health problem and the severity they perceive from its consequences influence their sense of threat and readiness to perform a health behavior. Individuals then consider enacting a health behavior in terms of its perceived benefits in reducing the threat, weighed against the barriers to performing the health behavior (Rosenstock, 1990). Of these four concepts, Barriers is often the strongest predictor of performance of suggested health behaviors (Janz and Becker, 1984).

The HBM is increasingly used to predict health behaviors that are more difficult and ongoing than the simpler prevention behaviors of earlier research. In order to

boost the HBM's power to predict more elaborate behaviors, some researchers (e.g., Kirscht, 1988; Rosenstock, 1990; Rosenstock et al., 1988) have expanded the HBM to include *self-efficacy,* the extent to which one feels able to perform particular behaviors, based on Bandura's (1986) social cognitive theory.

A primary research goal of this study is to explore the extent to which farmers' safety and health beliefs are related to the five theoretical constructs of the HBM. Among diverse samples, these constructs have explained much of the variance in beliefs regarding various health and safety behaviors and have predicted related behaviors. Therefore, it is likely that farmers' beliefs about their safety and health will be partially explained by HBM constructs. A secondary research goal is to determine whether farmers' safety and health beliefs are related to the value they attach to their health and their perceived ability to enact health-promoting behaviors.

# Methods

### Design and Participants

Study participants were part of the Certified Safe Farms (CSF) project that was designed to reduce injuries and illnesses among farmers. The CSF project was pilot-tested among farmers in a nine-county northwest Iowa area that is served by AgriSafe in Spencer, Iowa (Von Essen et al., 1997). AgriSafe is one of seven hospital-based clinics affiliated with the Iowa Center for Agricultural Safety and Health and the University of Iowa.

A random sample was drawn from phone directory lists of residents in a rural zip code area from the nine-county area. Residents were initially contacted by letter and asked, if they were farmers, to indicate, by returning a postcard, their possible interest in participating in CSF. Approximately 6% of 5,000 rural residents responded. Respondents were then screened to minimize possible self-selection biases. The screened sample was randomly assigned to the experimental group or control group. Results are based on the 259 participants in the CSF project's first year, 96% of whom were males.

The demographic and production characteristics of the experimental group ($\underline{n}$ = 141) and control group ($\underline{n}$ = 118) were similar. Each reported an average of 14 years of education and three household members. The average age was 49 years for the experimental group and 47 years for the control group, and 93% and 89% were married, respectively. Three-fourths of the income for both groups was from farming, the main occupation for both groups for about 30 years. Over 600 crop acres, on average, were farmed by farmers in each group. About one-third of each group produced cattle, while 41% of each group produced hogs.

### Procedure

Experimental group members completed study measures and an occupational health history about a week before they received occupational health screenings, which were followed by on-farm safety reviews. Control group members completed similar measures and received no services.

### Measures

**Farm Safety and Health Beliefs Scale.** The Farm Safety and Health Beliefs Scale (FSHBS) was tested in this study. The core meanings typically attached to HBM constructs were used in developing the following number of items for the constructs:

**Table 1. Factor analysis of the farm safety and health beliefs scale**

| Item | | Factor Loading | | | | |
|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 |
| *Factor 1: Susceptibility* | | | | | | |
| 36. | It's very likely that a family member or I will have a farm-related accident or illness. (1) | **0.68** | –0.02 | –0.09 | 0.09 | 0.11 |
| 6. | Common activities and parts of the physical environ-ment on our farm make it likely that someone will have a serious farm-related accident or illness someday. (1) | **0.57** | –0.02 | –0.10 | 0.15 | 0.09 |
| 16. | My usual stress level makes it likely that I'll have a farm-related accident someday. (1) | **0.53** | 0.09 | –0.14 | 0.07 | 0.09 |
| 1. | My heavy workload and long hours at work make it likely that I'll have a serious farm accident someday. (1) | **0.50** | 0.09 | –0.20 | 0.05 | –0.03 |
| 31. | Our farm's financial condition makes it likely that I'll have a farm-related accident or illness someday. (1) | **0.49** | –0.18 | 0.07 | 0.10 | 0.25 |
| 21. | I'm more likely than the average farmer to have a farm-related accident or illness. (1) | **0.39** | –0.21 | –0.16 | 0.28 | 0.03 |
| *Factor 2: Benefits* | | | | | | |
| 22. | Reducing farm hazards helps me meet my obligation to provide a safe workplace. (2) | –0.04 | **0.64** | 0.13 | –0.08 | –0.09 |
| 12. | The best way for me to protect my family's health is to reduce farm hazards. (2) | 0.02 | **0.47** | 0.12 | –0.04 | 0.08 |
| 17. | Spending money to reduce farm hazards is a good long-term way to save money. (2) | –0.04 | **0.46** | 0.27 | 0.02 | 0.13 |
| 23. | Removing hazards and focusing on farm safety and health practices are <u>not</u> high priorities compared to the other things I must do. (3) *Reverse* | 0.23 | **–0.46** | –0.31 | 0.08 | 0.17 |
| 7. | Eliminating farm hazards is one of the best ways to maintain my ability to work. (2) | 0.07 | **0.42** | 0.14 | –0.21 | 0.16 |
| 2. | Practicing good farm safety habits is one of the best ways to maintain my health. (2) | –0.07 | **0.40** | –0.10 | –0.07 | –0.06 |
| 27. | Correcting hazards on our farm reassures me and gives me peace of mind. (2) | 0.14 | **0.39** | 0.17 | –0.10 | 0.10 |
| *Factor 3: Barriers* | | | | | | |
| 35. | I'm always able to focus attention on practicing good safety and health habits, regardless of what is happening and how I feel. (4) *Reverse* | –0.17 | 0.03 | **0.59** | –0.34 | 0.05 |
| 37. | It's hard to find the time to eliminate hazards on our farm. (3) | 0.30 | –0.15 | **–0.52** | 0.09 | 0.26 |
| 18. | I'm likely to practice farm safety and health-protection behaviors even if they're uncomfortable or unpleasant. (3) *Reverse* | –0.06 | 0.18 | **0.51** | –0.13 | 0.10 |
| 3. | Many things keep me from correcting hazards and practicing good farm safety and health habits. (3) | 0.15 | –0.24 | **–0.39** | 0.16 | 0.33 |
| *Factor 4: Self-efficacy* | | | | | | |
| 10. | I'm quite accurate and thorough in identifying hazards on our farm. (4) | –0.08 | 0.15 | 0.25 | **–0.53** | 0.01 |
| 20. | I am very confident and competent in correcting hazards on our farm. (4) | –0.11 | 0.19 | 0.24 | **–0.50** | –0.09 |
| 25. | I'm able to correctly perform most farm safety and health-protection behaviors. (4) | –0.14 | 0.17 | –0.00 | **–0.46** | 0.02 |
| 26. | My alertness and concentration make it <u>unlikely</u> that I'll ever have a farm accident. (1) | –0.23 | –0.17 | 0.21 | **–0.42** | 0.00 |

Note: Boldface indicates highest factor loadings. (#) after each item indicates the HBM construct/factor for which that item was originally written. $\underline{n}$ = 259. *$\underline{p}$ < 0.05. **$\underline{p}$ < 0.001.

**Table 1 (cont.). Factor analysis of the farm safety and health beliefs scale**

| Item | Factor Loading | | | | |
|------|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| *Factor 5: Severity/Finances* | | | | | |
| 9. If a family member or I had a serious farm-related accident or illness, I'd face a major financial hardship. (5) | 0.15 | 0.20 | −0.13 | 0.02 | **0.57** |
| 13. I haven't corrected some farm hazards because of the related financial costs. (3) | 0.33 | −0.06 | −0.05 | 0.09 | **0.51** |
| 29. If a family member or I had a major farm-related accident or illness, our health insurance would not adequately cover the costs. (5) | 0.21 | −0.12 | 0.16 | 0.10 | **0.46** |
| Eigenvalue | 5.83 | 2.61 | 1.36 | 1.15 | 0.89 |
| % of variance | 14.95 | 6.70 | 3.47 | 2.94 | 2.28 |
| Coefficient alpha | 0.74 | 0.67 | 0.65 | 0.55 | 0.54 |
| Average inter-item correlation | 0.32 | 0.23 | 0.31 | 0.24 | 0.28 |
| *Factor Correlations* | | | | | |
| Factor 1 | --- | | | | |
| Factor 2 | −0.23** | --- | | | |
| Factor 3 | 0.44** | −0.43** | --- | | |
| Factor 4 | −0.36** | 0.29** | −0.47** | --- | |
| Factor 5 | 0.37** | 0.01 | 0.23** | −0.12* | --- |
| *Items That Did Not Load on a Factor* | | | | | |
| 32. Removing farm hazards is one of the best uses of time and money on our farm. (2) | −0.11 | 0.52 | 0.48 | 0.10 | −0.10 |
| 19. Our farm's viability would not be seriously threatened if a family member or I had a major farm-related accident or illness. (5) | −0.04 | −0.30 | 0.24 | 0.07 | −0.35 |
| 24. If a family member or I had a serious farm-related accident or illness, relationships within our family would be disrupted and strained. (5) | −0.01 | 0.08 | −0.12 | 0.16 | 0.32 |
| 30. I often don't correct possible farm hazards because I'm not sure how to do so. (4) | 0.40 | 0.02 | 0.04 | 0.32 | 0.27 |
| 28. I get used to overlooking safety and health hazards on our farm. (3) | 0.28 | −0.15 | −0.23 | 0.27 | 0.22 |
| 14. I'd be quite emotionally upset if a family member, employee, or I had a serious farm-related accident or illness. (5) | 0.06 | 0.38 | −0.09 | −0.12 | 0.21 |
| 15. I often don't practice the proper farm safety and health-protection procedures because I'm not sure how to do them right. (4) | 0.36 | −0.05 | −0.01 | 0.34 | 0.18 |
| 33. I'm less likely to practice farm safety and health-protection behaviors that make farming activities inconvenient or inefficient. (3) | 0.12 | −0.08 | −0.25 | 0.08 | 0.15 |
| 5. I'm always able to do what it takes to practice good farm safety and health habits. (4) | −0.05 | 0.16 | 0.37 | −0.30 | −0.15 |
| 34. A farm-related accident or illness would not harm my relationships with friends and neighbors. (5) | −0.07 | −0.17 | 0.06 | −0.24 | −0.12 |
| 11. The condition of our farm equipment decreases the chance of an accident. (1) | 0.03 | 0.23 | 0.05 | −0.38 | −0.11 |
| 4. My whole life would be negatively affected if a family member or I had a major farm-related accident or illness. (5) | −0.01 | 0.24 | −0.38 | −0.04 | 0.10 |
| 39. I don't like to appear overly concerned about protecting my safety and health. (3) | −0.05 | −0.31 | 0.03 | 0.06 | 0.09 |
| 38. The worst thing that could happen on our farm would be a serious injury to a child. (5) | −0.09 | 0.03 | −0.04 | −0.23 | −0.05 |
| 8. I always take the time to practice proper safety and health-protection habits. (3) | −0.17 | 0.20 | 0.44 | −0.45 | 0.02 |

Note: Boldface indicates highest factor loadings. (#) after each item indicates the HBM construct/factor for which that item was originally written. $\underline{n}$ = 259. *$\underline{p}$ < 0.05. **$\underline{p}$ < 0.001.

susceptibility (8); severity (8); benefits (7); barriers (9); and self-efficacy (7). The content of the original 39 items is indicated in table 1, along with the HBM construct used to write each item. Scale items refer to farm safety and health-promotion behaviors in general.

The items were written using principles of construct validity and scale development, especially those described in Clark and Watson's (1995) review. Consideration was given to appropriate reading level, likelihood of variability in responses, and avoidance of items that may tap multiple constructs. Farm health and safety professionals, farmers, and members of the CSF Advisory Committee evaluated items for content validity, clarity, possible biases, and response sets.

The FSHBS is a five-point Likert scale with an additional NA (not applicable) choice. Responses range from *strongly disagree* (1) to *strongly agree* (5) to the directions: *"The following items concern your beliefs about farm safety and health issues. Think of a variety of farm safety and health activities and consider these in general. Please answer each item by using the scale to write the number that best indicates how much you disagree or agree with each item—not what you think most people would answer."* A sample (Barriers) item is: "It's hard to find the time to eliminate hazards on our farm".

**Perceived Health Competence.** The Perceived Health Competence Scale (PHCS) is an eight-item, five-point Likert scale that measures perceived ability in managing one's health behaviors in general (Smith et al., 1995). Five diverse samples (total $\underline{n}$ = 1,106) reveal strong internal consistency, with coefficient alphas ranging from 0.82 to 0.90. The PHCS exhibits high stability over a one-week period and moderate stability over a period of 2.5 years. The PHCS is correlated with health behavior intentions, health locus of control, and a general sense of competence. Participants responded from *strongly disagree* (1) to *strongly agree* (5) to items such as: "I handle myself well with respect to my health". This scale was used to assess the convergent validity of the Self-efficacy and Barriers factors of the FSHBS.

**Health Value Scale.** The Health Value Scale (Lau et al., 1986) is a four-item, seven-point Likert scale that measures beliefs regarding the importance of personal health. Participants responded from *strongly disagree* (1) to *strongly agree* (7) to items such as: "There are few things more important than good health". This brief scale has yielded relatively constant internal consistency across five populations, ranging from 0.63 to 0.73. Test-retest reliability of 0.62 was reported over an 18-month period. This scale measured the convergent validity of the Benefits factor of the FSHBS.

**Statistical Analyses**

An exploratory factor analysis was conducted using the SYSTAT (Version 5.2.1; 1992) program for Macintosh. Responses to the 39 FSHBS items were subjected to a common factor analysis with varimax rotation (Floyd and Widaman, 1995). The convergent validity of three factors of the FSHBS was assessed by the Pearson product-moment correlations between the means of: (1) the Benefits factor and the Health Value Scale; (2) the Self-efficacy factor and the PHCS; and (3) the Barriers factor and the PHCS. $\underline{T}$-tests measured differences between the experimental and control groups' scores on the FSHBS factors, the PHCS, and the Health Value Scale.

# Results

**Factorial Validity.** Factor analysis of experimental and control group members' ($\underline{n}$ = 259) responses to the 39 FSHBS items revealed evidence of five independent factors regarding farmers' safety and health beliefs. These factors are consistent with the five main HBM constructs: Susceptibility (six items); Benefits (seven items); Barriers (four items); Self-efficacy (four items); and Severity (three items).

Table 1 shows all 39 original items and their factor loadings. The items that were included in a factor have moderate to strong primary loadings (0.39 and above) and secondary loadings that were ≤ 0.35. An item that cross-loaded more than 0.35 on a second factor was omitted. (The end of table 1 displays items that failed to meet the criteria of moderate to strong primary loading and low secondary loading.) The 24 items that met the inclusion criteria accounted for 30% of the total variance. Inter-factor correlations, shown in table 2, provide evidence that the five factors are independent measures of farmers' safety and health beliefs. Correlations range from –0.47 to 0.44 and are below a criteria of 0.50 (Clark and Watson, 1995).

Evidence of adequate internal consistency is provided by acceptable inter-item correlations. Average inter-item correlations for the factors ranged from 0.23 to 0.32, as shown in table 1, and were within the 0.15 to 0.50 range suggested by Clark and Watson (1995) to indicate acceptable internal consistency. All but two of the 51 separate inter-item correlations were within that range. Internal consistency was less strongly supported by each factor's Cronbach alpha. They ranged from 0.54 to 0.74, as shown in table 1, and were lowest for Self-efficacy and Severity.

Much weaker internal consistency is shown by grouping items according to the HBM categories for which items were originally written, rather than by the five factors. (These *a priori* categories are shown at the end of each item in table 1.) Cronbach alphas for these *a priori* categories are: Susceptibility, 0.53; Benefits, 0.68; Barriers, 0.21; Self-efficacy, 0.16; and Severity, 0.07. Inter-item correlations also indicated poor internal consistency for the *a priori* categories. Of the total of 134 inter-item correlations, a very large number (i.e., 40) were outside the acceptable 0.15 to 0.50 range (Clark and Watson, 1995). These results provide additional evidence of the advantages of using factor analysis to assess the structure of the original set of 39 items.

**Susceptibility to a Farm-related Accident or Illness.** Farmers' perceptions of vulnerability to an accident or illness were represented by six items regarding general likelihood, farm activities and environment, and stress. The stress-related items involved usual stress level, heavy workload and long hours, and the farm's financial

**Table 2. Means and standard deviations of FSHBS factors, perceived health competence, and health value**

| Measure | M | SD | Possible Range |
|---|---|---|---|
| FSHBS Factor | | | |
| Susceptibility | 2.39 | 0.54 | 1-5 |
| Benefits | 3.92 | 0.43 | 1-5 |
| Barriers | 2.77 | 0.62 | 1-5 |
| Self-efficacy | 3.44 | 0.46 | 1-5 |
| Severity/Finances | 2.99 | 0.73 | 1-5 |
| Health Attitude | | | |
| Perceived health competence | 3.60 | 0.46 | 1-5 |
| Health value | 5.37 | 1.04 | 1-7 |

$\underline{n}$ = 259.

condition. Farmers scored lowest on the Susceptibility factor, $\underline{M}$ = 2.39, $\underline{SD}$ = 0.54, which accounted for 15% of the variance.

**Benefits of Performing Safety/health Behaviors.** The Benefits factor contained seven items regarding farmers' views of the benefits of removing hazards and practicing good safety/health habits: (1) meet an obligation to provide a safe workplace; (2) protect family's health; (3) save money in the long-term; (4) general priority (reverse scored); (5) maintain ability to work; (6) maintain personal health; and (7) provide peace of mind. The Benefits factor had the highest average of the five factors, $\underline{M}$ = 3.92, $\underline{SD}$ = 0.43, and accounted for 6.7% of the variance.

**Barriers to Performing Safety/health Behaviors.** Perceptions of barriers to removing hazards and practicing proper safety and health behaviors were depicted by four items: (1) ability to focus attention on safety/health habits (reverse scored); (2) inadequate time for proper practices; (3) uncomfortable or unpleasant (reverse scored); and (4) numerous barriers. A higher Barriers score reflects greater barriers, so two items were reverse scored in subsequent analyses. Overall, farmers expressed a slight level of disagreement with the Barriers factor, $\underline{M}$ = 2.77, $\underline{SD}$ = 0.62, which accounted for 3.5% of the variance.

**Self-efficacy to Perform Safety/health Behaviors.** The Self-efficacy factor contains four items regarding farmers' perceived abilities to correct hazards and perform safety/health behaviors in a manner that is: (1) accurate and thorough; (2) confident and competent; (3) correct; and (4) associated with alertness and concentration. Farmers' average score on the Self-efficacy factor, $\underline{M}$ = 3.44, $\underline{SD}$ = 0.46, was the second highest among the five factors. It accounted for 2.9% of the variance.

It is noteworthy that items regarding *self-efficacy* and *barriers* yielded two separate factors. This supports those who conceptualize self-efficacy as a separate HBM factor with distinct theoretical qualities and applications (Kirscht, 1988; Rosenstock, 1990; Rosenstock et al., 1988), rather than as a part of the Barriers factor. Although the Self-efficacy and Barriers factors show a moderate negative correlation, $\underline{r}$ = −0.47, $\underline{p}$ < 0.001, it is within the 0.50 criteria suggested by Clark and Watson (1995).

**Severity/finances of the Consequences of Farm-related Safety or Health Problems.** The extent to which farmers feel that farm-related safety and health issues create problems for them was represented by three items: (1) major financial hardship; (2) related costs of correcting hazards; and (3) inadequate health insurance. This factor is labeled Severity/Finances to reflect the emphasis on financial concerns, especially as the result of a farm-related accident or illness. Average scores on the Severity/Finances factor were neutral, $\underline{M}$ = 2.99, $\underline{SD}$ = 0.73, and it accounted for 2.3% of the variance.

**Convergent Validity: Factor Correlations with Perceived Health Competence and Health Value.** Support for the convergent validity of the FSHBS is provided by

**Table 3. Correlations between health attitude scales and factors**
**of the farm safety and health beliefs scale**

| Factor | Perceived Health Competence | Health Value |
|---|---|---|
| Susceptibility | −0.35** | −0.09 |
| Benefits | 0.32** | 0.29** |
| Barriers | −0.35** | −0.15* |
| Self-efficacy | 0.32** | 0.09 |
| Severity/Finances | −0.26** | 0.09 |

$\underline{n}$ = 259.
*$\underline{p}$ < 0.05. **$\underline{p}$ < 0.001.

correlations, shown in table 3, between appropriate FSHBS factors and farmers' attitudes regarding their general ability to perform health behaviors and the importance of personal health. Self-efficacy is positively correlated with Perceived Health Competence (PHC; Smith et al., 1995), $r = 0.32$, $p < 0.001$, while Barriers is negatively correlated with PHC, $r = -0.35$, $p < 0.001$. The value farmers' place on their health (Health Value Scale; Lau et al., 1986) is positively correlated with the Benefits factor, $r = 0.29$, $p < 0.001$, supporting its convergent validity.

**Comparisons between Experimental and Control Groups.** The experimental group and the control group showed no differences in their beliefs regarding farm safety and health (i.e., the five FSHBS factors). Nor were differences found in their sense of feeling able to perform health-protective behaviors (i.e., Perceived Health Competence) and the value they place on health (i.e., Health Value). These results are consistent with the measures being administered at baseline (i.e., before the health screening for experimental group members).

# Discussion

In general, these results provide evidence that farmers' beliefs about their safety and health can be summarized by five distinct Health Belief Model-related factors: Susceptibility to a farm-related accident or illness; Benefits to performing farm safety and health behaviors; Barriers to performing safety and health behaviors; Self-efficacy regarding performing these behaviors; and Severity/Finances concerning safety or health problems. These five factors can best be represented by 24 of the original 39 items. However, low internal consistency, particularly for Self-efficacy and Severity, points to the need for future scale revision.

Evidence of a moderate level of convergent validity of the FSHBS was also revealed. Farmers' perceptions of their abilities to perform health behaviors in general were moderately correlated with their views of their abilities to perform farm safety and health behaviors. Farmers who feel more able to perform general health behaviors also perceive more benefits and fewer barriers to practicing related protective behaviors specific to farming. They also feel less vulnerable to farm-related accidents and illnesses and expect less severe related consequences. Last of all, farmers who place more value on their overall health tend to place more value on the benefits of practicing proper farm safety and health practices.

Farmers' relative scores on the five factors are worth noting. Farmers scored highest on the Benefits factor, followed by the Self-efficacy factor. This corresponds to findings that farmers tend to acknowledge the importance of practicing proper safety techniques and express adequate knowledge of such techniques. Farmers scored lowest on the Susceptibility factor, and, on average, tended to somewhat disagree with these items regarding the likelihood of experiencing a farm-related accident or illness. Given their actual prevalence, this suggests an optimistic bias on the part of farmers. Thus, farmers appear similar to others in feeling unrealistically optimistic about their invulnerability to harm (Weinstein, 1989; Weinstein and Nicolich, 1993).

These findings preliminarily suggest that the FSHBS may be used as an education and screening tool to assist professionals in developing community-based programs (Shutske and Ohmans, 1995). Agricultural health and safety professionals may consider mental health professionals as allies in developing common health, safety, and mental health programs (National Association for Rural Mental Health, 1999), and the FSHBS may aid their mutual efforts. For example, the FSHBS may be used as an educational or screening tool during public screenings (e.g., at county fairs) or during private, clinic- or farm-based interventions. Farmers who score high

on Barriers or Susceptibility or low on Self-efficacy could be encouraged by staff to participate in future safety programs.

Farmers' scores on particular FSHBS factors may guide others as they encourage farmers to make changes in their safety and health practices. For example, farmers who score high on Barriers may be encouraged to discuss the specific ways in which they find it difficult to focus their attention and time on practicing proper farm safety/health behaviors. A brief plan of action to overcome these barriers could be agreed upon and discussed with family members. The scale may be amenable to such flexible uses because the items refer to general, non-specific, farm safety and health behaviors.

The use of the FSHBS as an outcome evaluation tool will be assessed in the future. As the CSF project progresses, the FSHBS factors will be used to predict the experimental groups' safety review scores and the relative injury and health status of the experimental and control groups.

## Limitations and Future Research

Limitations of the FSHBS focus on internal consistency and sample characteristics. As previously noted, the coefficient alphas for the five factors ranged from 0.54 to 0.74. Future revision of the FSHBS will allow additional and revised items to be tested, particularly for the Self-efficacy and Severity factors.

The FSHBS was developed among Iowa farmers who generally represent Midwestern farmers on key qualities. However, despite screening efforts, the CSF participants vary somewhat from average Iowa farmers in injury rates, number of crop acres, and percent of cattle and hog producers. This sample may not generalize well to all regions, such as the South with its greater share of African American farmers who may have different experiences (e.g., limited credit availability).

The current FSHBS is limited by being mainly developed with men, the main participants in CSF. Gender-based differences in farm tasks (Lobao and Meyer, 1995; Rosenfeld, 1985) may contribute to findings of gender-based differences in rates and types of injuries, risk factors, and perceptions and prioritization of farm safety and health issues (Dewar, 1996; Stueland et al., 1997). Gender differences in farm stressors and stress symptoms (Walker and Walker, 1987, 1988) may also contribute to gender differences in FSHBS factors. Future gender-balanced testing of the FSHBS may help develop programs to promote the health and safety of men and women farmers.

## References

Bandura, A. 1986. *Social Foundations of Thought and Action.* Englewood Cliffs, N.J.: Prentice Hall.

Clark, L. A., and D. Watson. 1995. Constructing validity: Basic issues in objective scale development. *Psychological Assess* 7: 309-319.

Conger, R., and G. Elder, eds. 1994. *Family in Troubled Times: Adapting to Change in Rural America.* New York, N.Y.: Aldine de Gruyter.

Dewar, D. M. 1996. Farm health and safety issues: Do men and women differ in their perceptions? *AAOHN J* 44(8): 391-401.

Donham, K. J., B. Kross, J. Merchant, and D. Pratt. 1990. Agricultural, occupational, and environmental health: Policy strategies for the future—The scientific basis. *Am J Ind Hyg,* Special Issue, Part I-III 8(2-4): 105-527.

Donham, K. J., and K. M. Thu. 1993. Relationships of agricultural and economic policy to the health of farm families, livestock, and the environment. *J Am Vet Med Assoc* 202: 1084-1091.

Elkind, P. 1991. Attitudes and risk behavior. In *Papers & Proc Surgeon General's Conference on Agricultural Safety and Health,* eds. M. L. Myers, R. F. Herrick, S. A. Olenchock et al., 123-128. Department of Health and Human Services (NIOSH) Pub. No. 92-105.

Elkind, P. D., and H. Cody-Salter. 1994. Farm stressors: The hazards of agrarian life. *Annals Agric & Environ Med* 1: 23-27.

Floyd, F. J., and K. F. Widaman. 1995. Factor analysis in the development and refinement of clinical assessment instruments. *Psychological Assess* 7(3): 286-299.

Geller, J. M., R. L. Ludtke, and T. Stratton. 1990. Nonfatal farm injuries in North Dakota: A sociological analysis. *J Rural Health* 6(2): 185-196.

Goudy, W., M. En-hua, L. D. Wang, S. C. Burke, M. Harlan, and D. Anthony. 1997. Injuries and fatalities on farms in Iowa's counties: 1990-1996. In *Iowa's Counties: Selected Population Trends, Vital Statistics, and Socioeconomic Data*, ed. W. Goudy, S. C. Burke, and M. Hanson. Ames, Iowa: Iowa State University.

Harrison, J. A., P. D. Mullen, and L. W. Green. 1992. A meta-analysis of studies of the Health Belief Model with adults. *Health Ed Res* 7(1): 107-116.

Hochbaum, G. M. 1958. *Public Participation in Medical Screening Programs: A Sociopsychological Study.* Public Health Service Publication No. 572. Washington, D.C.: GPO.

Janz, N. K., and M. H. Becker. 1984. The Health Belief Model: A decade later. *Health Ed Quar* 11(1): 1-47.

Kidd, P., T. Scharf, and M. Veazie. 1996. Linking stress and injury in the farming environment: Secondary analysis of qualitative data. *Health Ed Quar* 23(2): 224-237.

Kettner, K. A., Geller, J. M., Ludtke, R., and J. Kelley. 1988. Economic hardship and stress among farm operators in North Dakota: The buffering effect of social support. *The Great Plains Sociol* 1(1): 69-88.

Kirscht, J. P. 1988. The Health Belief Model and predictions of health actions. In *Health Behavior: Emerging Research Perspective,* ed. D. S. Gochman, 27-41. New York, N.Y.: Plenum.

Krebs, A. V. 1992. *The Corporate Reapers.* Washington, D.C.: Essential Books.

Lau, R. R., K. A. Hartman, and J. E. Ware. 1986. Health as a value: Methodological and theoretical considerations. *Health Psychol* 5(1): 25-43.

Lazarus, R. S., and S. Folkman. 1984. *Stress, Appraisal, and Coping.* New York, N.Y.: Springer.

Lobao, L., and K. Meyer. 1995. Restructuring the rural farm economy: Midwestern women's and men's work roles during the farm crisis period. *Economic Develop Quart* 9: 60-73.

Merchant, J. A., S. J. Reynolds, and C. S. Zwerling. 1995. Work in agriculture. In *Epidemiology of Work-related Diseases*, ed. J. C. McDonald, 267-292. London, England: BMJ Publishing.

Murphy, D. J. 1981. Farm safety attitudes and accident involvement. *Accident Analysis & Prev* 13: 331-337.

National Association for Rural Mental Health. 1999. *Party-Line*, 7, Special issue: Farm crisis and mental health.

National Coalition for Agricultural Safety and Health. 1989. *Agriculture at Risk: A Report to the Nation.* Iowa City, Iowa: Author.

National Safety Council. 1995. *Accident Facts.* Chicago, Ill.: Author.

Perry, M. J., and F. R. Bloom. 1998. Perceptions of pesticide associated cancer risks among farmers: A qualitative assessment. *Human Organiza* 57(3): 342-349.

Popendorf, W., and K. J. Donham. 1991. Agricultural hygiene. In *Patty's Industrial Hygiene and Toxicology*, 14th Ed. Vol. 1, Part A, eds., G. D. Clayton, and F. E. Clayton, 721-761. New York, N. Y.: Wiley.

Rodriquez, L. A., C. V. Schwab, J. W. Peterson, and L. J. Miller. 1997. The impact of an Iowa Public Information Campaign. *JASH* 3(2): 109-123.

Rosenfeld, R. A. 1985. *Farm Women: Work, Farm and Family in the United States*. Chapel, N.C.: University of North Carolina Press.

Rosenstock, I. M. 1974a. Historical origins of the Health Belief Model. In *The Health Belief Model and Personal Health Behavior,* ed. M. H. Becker, 1-8. Thorofore, N.J.: C. B. Slack.

_____. 1974b. The Health Belief Model and preventive health behavior. In *The Health Belief Model and Personal Health Behavior,* ed. M. H. Becker, 27-59. Thorofore, N.J.: C. B. Slack.

_____. 1990. The Health Belief Model: Explaining health behavior through expectancies. In *Health Behavior and Health Education: Theory, Research, and Practice,* ed. K. Glanz, F. M. Lewis, and B. K. Rimer, 39-62. San Francisco, Calif.: Jossey-Bass.

Rosenstock, I. M., V. J. Strecher, and M. H. Becker. 1988. Social learning theory and the Health Belief Model. *Health Ed Quar* 15(2): 175-183.

Sharf, T., P. Kidd, H. Cole, T. Bean, L. Chapman, K. Donham, and D. Baker. 1998. Intervention tools for farmers—Safe and productive work practices in a safer work environment. *JASH,* Special Issue 1: 193-203.

Shutske, J. M., and P. J. Ohmans. 1995. Shifting the paradigm: Rethinking our approach to agricultural safety and health issues. *J Agromed* 2(3): 39-46.

Smith, M. S., and K. A. Wallston. 1992. How to measure the value of health. *Health Ed Res* 7(1): 129-135.

Smith, M. S., K. A. Wallston, and C. A. Smith. 1995. The development and validation of the Perceived Health Competence Scale. *Health Ed Res* 10(1): 51-64.

Stueland, D. T., B. C. Lee, D. L. Nordstrom, P. M. Layde, L. M. Wittman, and P. D. Gunderson. 1997. Case-control study of agricultural injuries to women in central Wisconsin. *Women & Health* 25(4): 91-103.

SYSTAT. 1992. *SYSTAT: Statistics,* Ver 5.2 Ed. Evanston, Ill.: SYSTAT, Inc.

Thu, K. 1998. The health consequences of industrialized agriculture for farmers in the United States. *Human Organiza* 57: 335-341.

Thu, K., P. Lasley, P. Whitten, M. Lewis, K. Donham, C. Zwerling, and R. Scarth. 1997. Stress as a risk factor for agricultural injuries: Comparative data from the Iowa Farm Family Health and Hazard Survey (1994) and the Iowa Farm and Rural Life Poll (1989). *J Agromed* 4(3/4): 181-191.

U.S. Department of Agriculture. 1994. 200,000 farm injuries in 1993. Bulletin from the National Agricultural Statistics Service, 23 December 1994. Washington, D.C.: Author.

Von Essen, S., K. Thu, and K. Donham. 1997. Insurance incentives for safe farms. *J Agromed* 4: 125-128.

Walker, J. L., and L. J. S. Walker. 1988. Self-reported stress symptoms in farmers. *J Clinical Psychol* 44(1): 10-16.

Walker, L. S., and J. L. Walker. 1987. Stressors and symptoms predictive of distress in farmers. *Family Relations* 36(4): 374-378.

Walker, J. L., L. S. Walker, and P. M. MacLennan. 1986. An informal look at farm stress. *Psychological Reports* 59: 427-430.

Weinstein, N. D. 1989. Perceptions of personal susceptibility to harm. In *Primary Prevention of AIDS: Psychological Approaches,* eds. V. W. Mays, G. W. Albee, and S. F. Schneider, 142-167. Newbury Park, Calif.: Sage.

Weinstein, N. D., and M. Nicolich. 1993. Correct and incorrect interpretations of correlations between risk perceptions and risk behaviors. *Health Psychol* 12(3): 235-245.

Zwerling, C., N. L. Sprince, R. B. Wallace, C. S. Davis, P. S. Whitten, P. S., and S. G. Heeringa. 1995. Occupational injuries among agricultural workers 51-61 years old: A national study. *JASH* 1(4): 273-281.