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Barriers to the adoption of ergonomic innovations to control musculoskeletal disorders and improve performance

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ABSTRACT

Despite a growing number of published articles describing studies of ergonomic interventions, little is known about the barriers potential adopters face when deciding whether or not to adopt such innovations. To this end, the purpose of this paper is to examine the barriers identified by potential adopters of ergonomic innovations and compare barriers identified by individuals not interested in adopting to those identified by individuals planning to adopt. Eight hundred forty-eight fresh market vegetable farmers were mailed surveys measuring the adoption of and barriers to the adoption of several ergonomic innovations as part of a multi-year intervention study. Barriers such as cost, lack of information, never having seen the innovation used and not being able to try out the innovation were among the barriers identified. The barriers identified were moderated by whether or not the respondents were likely to adopt. Implications for diffusing ergonomic and safety innovations are discussed.

1. Introduction

Studies of the adoption of innovations have occurred in a wide variety of industries and have examined a wide variety of innovations (Abbott and Yarbrough, 1992; Castle, 2001; Da Villa and Panizzolo, 1996; Qazi et al., 1993; Swan, 1995; Walston et al., 2001). However, despite a growing number of published ergonomic intervention studies (Karsh et al., 2001; NRC/IOM, 2001), relatively little has been examined empirically to uncover the barriers potential adopters face when deciding whether or not to adopt ergonomic innovations. This is particularly surprising in the agricultural sector because of its rich tradition of diffusion of innovation research (Rogers, 1995) and recognized musculoskeletal problems (Maeda et al., 1980; Palmer, 1996; Sakakibara et al., 1987). The adoption of ergonomic innovations in agriculture, specifically fresh market vegetable farms, is the focus of this paper.

Quite a bit is known about the factors that promote or inhibit the adoption of production innovations in agriculture. In general, adopters have tended to be managers who faced the fewest economic constraints that could thwart adoption (Bzugu, 1995) and had the best access to information about the innovation (Rogers, 1995; Feder and Umali, 1993; Fliegel, 1993). The results are not always consistent, however (Qazi et al., 1993). In addition, innovation-specific factors such as ease of use have sometimes been found to be more predictive of the adoption of production innovations than manager or farm specific characteristics (Adesina and Zinnah, 1993; Adesina and Seidi, 1995; Adesina and Baidu-Forson, 1995; Negatu and Parikh, 1999; Wossink et al., 1997). However, as mentioned, there is little empirical evidence as to what the predictors or barriers to the adoption of ergonomic innovations might be for general industry, or fresh market vegetable growers specifically.

Fresh market vegetable growers are prime candidates for using ergonomic innovations because producing fresh market vegetables requires soil preparation, planting, transplanting, weeding, hand harvesting, and product handling tasks including washing, packing, and loading boxed produce. Many of these activities may involve extensive and inefficient hand labor, high levels of physical effort, and high demands on the musculoskeletal system (Nag, 1998; van Dieen et al., 1997; Cavaletto et al., 1994).

In the present study ergonomic innovations (i.e. available technologies with little use in the target population) that had the potential to both reduce musculoskeletal disorders and improve the profitability of the farm operation were promoted to fresh market vegetable growers in a four-state region. The purpose of this paper is to identify the perceived relative importance of possible

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barriers to the adoption of five ergonomic innovations. Farmers who reported being unlikely to adopt were believed to be in the awareness stage, persuasion stage, or decision stage, while those reporting that they were planning to adopt were in the persuasion or decision stage (Rogers, 1995). Those two groups were likely to have different barriers preventing them from having adopted the innovation, because as Rogers (1995) points out, the informational needs of individuals at the different stages are different. It was hypothesized that the barriers identified by farmers who intended to adopt an innovation in the future would be different from those identified by farmers who stated they did not intend to adopt the innovation in the near future.

2. Methods

2.1. Design

This paper reports on the third year of an intervention study (year 2000) for fresh market vegetable farmers aimed at improving safety and efficiency on the farm. Baseline information was collected in 1998, and post-intervention data in 1999 and 2000. After the baseline year, innovations that could improve farm safety and efficiency were promoted to the target population and surveys were used to assess the impact of the interventions on farmer adoption, awareness, and perceptions of each innovation. Each year, a new subset of farmers is randomly selected from the target population to receive the intervention evaluation survey (rolling sample cohort).

2.2. Subjects

There was little comprehensive information about fresh market vegetable growers, so a sampling frame based on available sources was developed. We were able to obtain a vegetable growers' magazine subscription list, a vegetable seed suppliers' customer list, and lists from three other states' vegetable producer associations. Our sampling frame included Wisconsin, Minnesota, Michigan, and Iowa. There were 4258 farms in this list. Of those, we randomly sampled 1/5 ($n = 851$) so that there would be independent samples of similar size for the next five years. In 2000, three of the 851 were discovered not to be fresh market vegetable farms, so the final sample size was 848.

2.3. Procedure

A mail questionnaire based on standardized recommendations (Dillman, 1978, 1991) was developed which, in total, required between 10 and 20 min to complete. The cover page requested that the questionnaire be filled out by the farm operator or the person who made most of the management decisions about how the operation ran. As an incentive to encourage responses, the accompanying cover letter stated that individuals who completed and returned the questionnaire would receive ten first class US postage stamps. A series of follow-up mailings to non-respondents, including a reminder postcard nine and 27 days later and a repeated mailing of the questionnaire and cover letters at 18 days later were conducted for non-respondents (Dillman, 1991, 1978). The protocol was approved by the University of Wisconsin – Madison College of Agricultural and Life Sciences human subjects committee.

2.4. Intervention conceptual model

The intervention plan incorporated a number of well-known theoretical models (Rogers, 1995) and previous experiential research findings about how and why individuals adopt agricultural technologies (e.g. Feder and Umali, 1993; Fliegel, 1993). In Rogers' model, the farm manager is believed to proceed through various stages in a sequential fashion from awareness to evaluation to trial and use of the innovation (Rogers, 1995). Both the messages and format of the intervention need to be targeted to the farm manager audiences at each stage.

2.5. Intervention components

The intervention effort incorporated social marketing principles and the audience was segmented according to the stages in the theoretical model. Materials were then developed and delivery vehicles enlisted that would be most appropriate for each segment of the target audience (Rogers, 1995). The intervention was delivered through printed mass media read by fresh market vegetable growers, distribution of two-page tip sheets, grower meetings, university extension agents, farmer-to-farmer exchanges at pilot farms, radio segments, and a website (see Chapman et al., 2004 for details).

2.6. Innovations

A list of potential innovations that improved safety, specifically musculoskeletal health, and profitability for fresh market vegetable growers was developed. The innovations were discussed with resource people and farmers to select innovations that had the potential to cause the greatest positive impact on both safety and profitability. The selection process included considering how many workers would be affected, what proportion of the work year would be affected, what type of work postures would be improved, and how long it would take for the innovation to pay for itself. We focused on production method innovations that were low cost and improved work efficiency so they would be attractive and practical for most or all small-scale growers. Four innovations were promoted in the first year (1998) after the baseline surveys were collected. More complete descriptions for each, including their benefits and costs, are available at http://bse.wisc.edu/hfhp/tipveggy.htm.

- Mesh bags are a labor aid to handle leafy crops or other small produce items such as green beans during harvest, washing, and packing. Typically, the washing, sorting, weighing, and packing of leafy crops involves repeated grasping and reaching retrieval movements; often in bent-over postures. A mesh bag can reduce the number of grasps and increase the size of the crop bunch handled, in effect turning each activity into a batch process operation. Picking into a mesh bag can reduce the number of grasps and increase the size of the crop bunch handled, in effect turning each activity into a batch process operation (Meyer et al., 1999). A mesh bag costs $2–$6, and has a very quick payback period considering the immediate time-savings and low cost.
- Standard plastic containers designed for vegetables are an advantage in general crop handling during harvest, post-harvest handling, and marketing. Many growers use whatever containers are available for manually moving crops. Often these containers have no or poor handles, are not stackable and cannot nest. Standard containers designed for vegetables are easy to lift, can be sized to contain manageable loads, are UV stable and long lasting, do not have sharp or rough edges, and save space because they are nestable and stackable. Standards containers are available at $5–$10 each, with very quick payback given their low cost and immediate impact on storage space, ease of lifting, and harvested crop quality.