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Using the Health Action Model to plan food safety educational materials for Hispanic workers in the mushroom industry

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Abstract

Sometimes educational materials do not work because they are designed without examining the worksite social and environmental factors affecting the target audience. Educational materials based on application of theory-based models may address more effectively the cause of food safety problems. The objective of this project was to use the Health Action Model (HAM) as a framework for developing food safety educational materials for Hispanic workers in the mushroom industry. HAM identifies five constructs or systems that represent conditions surrounding mushroom workers: Baseline food safety knowledge, normative system, motivational system, food safety/belief system, and appropriate working environment and conditions. Some refinements of the motivational construct were made for its use in this research. The Health Action Model provided a framework in which the variables that influence food safety behaviors were identified and described. The findings provided by using this framework were helpful to identify factors that should be taken into account in designing an educational intervention for Hispanic workers in the mushrooms industry. It is felt that the HAM model can be used as a guide to develop customized food safety educational materials at a variety of different settings and target audiences in food production facilities.

Keywords: Health Action Model; Food safety education; Hispanic workers; Mushroom industry

1. Introduction

Foodborne illnesses are an overwhelming public health problem in the US costing the food industry billions of dollars yearly. Education and training of food handlers is critical since worker mishandling caused most of the outbreaks reported in the food industry (WHO, 2000). The Pennsylvania (PA) mushroom industry began a *pro-active* process to institute worker food safety training in 2002.

1.1. The PA mushroom industry workforce

Pennsylvania accounted for 56% of the $889 million in US mushroom crop sales in 2002–2003 (USDA, 2003), mainly due to mushroom companies located in Kennett Square, PA, the self described "Mushroom Capital of the World" (Flammini, 1999). Manual labor is involved in all phases of mushroom farming and packing. Currently, approximately 95% of the mushroom workers in southeast PA are Mexicans coming from economically depressed areas in Mexico. Most Mexican migrant workers in US are men between 25 and 34 years of age. This Hispanic group has low income, low educational level and little political influence in US, but their socio-economical level is still higher than in Mexico

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(Aguayo, 2000). The Central Mexican Bank (Banco de Mexico) reported that, in 2003, the Hispanic workforce of Mexican origin in the USA sent $13.266 billion back to Mexico (Banco de México, 2004). Although, there have been no foodborne outbreaks attributed to consumption of fresh mushrooms in the US, mushroom buyers are requesting that their suppliers provide third party food safety audits of their facilities to assure safe produce for their consumers, thus creating a need for food safety training.

1.2. Food safety education materials

Currently, hundreds of food safety educational materials are available, but none has been specifically designed for the mushroom industry and most materials were designed for English speaking audiences. Not much is known about food safety knowledge and practices of Hispanic workers, since only a few consumer studies involving Hispanics have examined food safety issues (Bell, Hillers, & Thomas, 1999a, 1999b; Diaz-Knauf et al., 1995; Meer & Misner, 2000; Penner, Boone, & Lubbers, 2001).

Unfortunately, differences in cultural, economic and social factors associated with workers themselves make it difficult to use the same educational food safety program in all situations (Foster & Kaferstein, 1985). Additionally, educational materials may not be effective if they are designed without looking at the worksite social, physical, and environmental factors surrounding the target audience. Food safety education is most likely to be effective when it is designed specifically for the audience (Hispanic workers) and the particular hazard of interest (mushroom handling; Medeiros, Hillers, Kendall, & Mason, 2001). The mushroom industry therefore needs food safety training materials that take into account the cultural attributes and worksite environment of their Hispanic workforce.

Sociologists suggest examining target audience food safety beliefs and behaviors before planning any food safety intervention (Foster & Kaferstein, 1985). Theory can provide a framework for relating beliefs to other individual and worksite factors that affect worker behavior and help identify the sources of the problem for which educational materials are being developed. Other health related fields have relied heavily on theoretical frameworks as guides to develop educational materials and to predict individual's behaviors (Janz & Becker, 1984). Although a few studies in the food safety education field have used theory to predict food safety behaviors (Hanson & Benedict, 2002; Schafer, Schafer, Bultena, & Hoiberg, 1993), more research using theoretical frameworks would benefit the food safety education field.

1.3. The Health Action Model (HAM)

HAM was chosen as the framework for development of a food safety educational intervention for Hispanic mushroom workers. Developed by Tones, the HAM conceptually incorporates the Health Belief Model and Ajzen and Fishbein's Theory of Reasoned Action (Tones, Tilford, & Robinson, 1990). For use in food safety research, Rennie (1995) adjusted the definitions of its five constructs or systems, all of which influence behavior, as follows: (a) knowledge system: baseline food safety knowledge; (b) normative system: worksite norms and rules; (c) motivational system: motivational elements in the company; (d) belief system: values and beliefs of the target audience; and (e) worksite environmental system: worksite physical conditions (see Fig. 1). The normative system influences both the motivational system and the belief system. The motivational system can also influence both the belief system and the outcome of the belief system, behavioral intent. If the relevant skills and knowledge and the appropriate environment are present, then behavioral intent can lead to action. The belief system is the core of the framework since it is interrelated with the normative system, the motivational system and baseline knowledge. HAM takes into account the social and environmental factors that surround the individual. These factors can facilitate or hinder actions depending on the resources available to change these conditions. For example, despite behavioral intent, workers will not wash their hands if hand-washing facilities are not available.

Concepts from Expectancy Theory (ET) as defined by Vroom (Campbell & Pritchard, 1983; Tubbs, Boehne, & Dahl, 1993) were added to HAM to define the motivational system (see Fig. 1). Motivation is an internal process that activates, guides and maintains behavior over time. ET is used in industrial and organizational psychology and adult education to motivate people (Baron & Kalsher, 1997; Burns, 1995; Goad, 1982). Company motivational practices can directly affect employees' beliefs and can lead to adoption of behaviors supporting food safety practices. ET includes three concepts; valence, instrumentality and expectancy (Smith & Shillam, 2000). Expectancy is the belief that extra effort will lead to improved performance. Instrumentality is the belief that good performance will be noticed or ewarded. Valence is the value placed on the rewards offered. These three affective elements include values and beliefs that support the core belief system as well as influence behavioral intent.

This modified version of HAM was used in this research to design and conduct a needs assessment in the PA mushroom industry to provide data upon which a food safety education program would be based. The objectives of this paper are to report (a) the way this

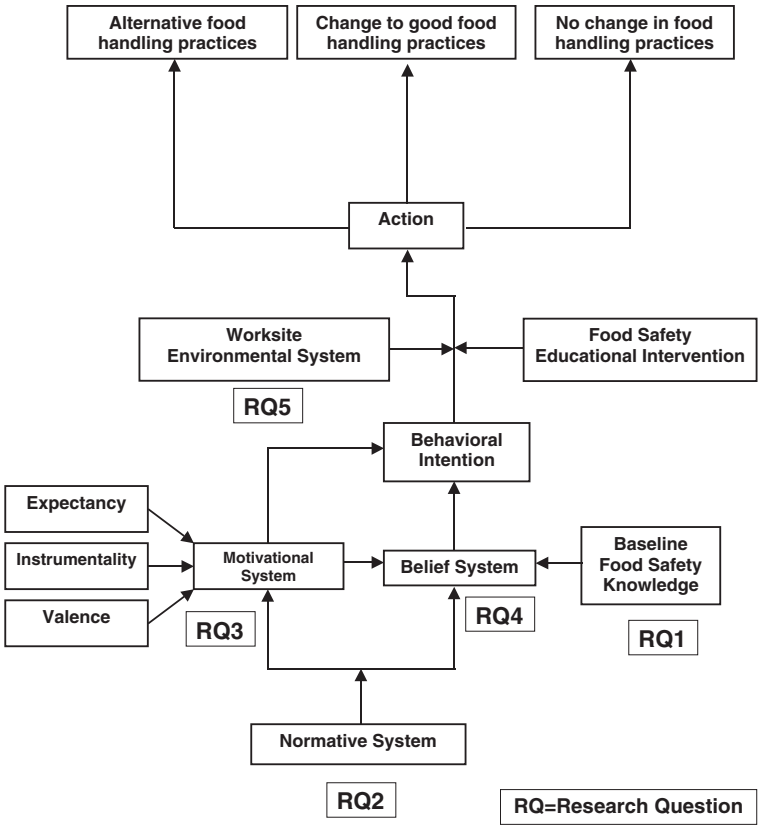

Fig. 1. The Health Action Model for Hispanic mushroom worker needs assessment.

needs assessment was designed, (b) what was learned from the needs assessment and (c) to assess the value of HAM in this process.

2. Methodology

Based on HAM five research questions were developed, four of which focused on one of the model systems and one on target audience baseline knowledge. To answer these questions, the needs assessment used three methods: (1) observations, (2) individual interviews, and (3) focus groups, all of which were conducted in Spanish. Table 1 lists each research question and which methods helped to answer it. The relationship of the research questions to the HAM model systems is shown in Fig. 1. The Penn State University Office of Research Protections approved all procedures.

2.1. Company sample

All mushroom companies (packers, growers, or both) affiliated with the America Mushroom Institute (AMI) were sent a fax by AMI explaining the project. The study was also publicized at the Penn State Mushroom Workshop in Spring 2002. Subsequently, all eligible

Table 1
Research questions and addressing method

Research question	Questions (Health Action Model system)	Methodology used to address the question
1	What do the workers know about food safety? (Knowledge system)	Individual interviews
2	What are the norms and rules followed in growing and packing facilities? (Normative system)	Individual interviews, direct observations, focus groups
3	What factors motivate the workers to follow the food safety rules? (Motivational system)	Focus groups
4	What are the workers beliefs and attitudes about food safety and foodborne illness? (Food safety belief system)	Individual interviews focus groups
5	What is the worker's working environment like? (The worksite environmental system)	Direct observations, focus groups

companies were contacted in the order derived from a randomized list to determine interest. Finally, a meeting was set up with the management staff of each interested company to provide a detailed explanation of the project, the instruments and the commitments involved and to request a formal letter of agreement from the company. Ultimately, seven companies agreed to participate in this stage of the project. Each provided a letter of agreement, although one company required a confidentiality agreement.

2.2. Observations at companies

One observer conducted an 'observation procedure' at each participating company that examined all production steps, from growing to finished product, as well as the workers' practices during work and break time. The observer was free to move within the mushroom packing facilities or the growing farms. Two full days of observation were conducted at companies that had both a packing room and growing farms. If the company only grew mushrooms, the observation period was shortened to one day. The observer worked 1–3 hours at every employee workstation and position in a mushroom packing company. At the farms, the observer picked mushrooms and worked with some of the crews performing different tasks. The amount of time spent at each station or with each crew varied depending on the information that was being collected. As the observer worked, short notes were taken of observations and at the end of the observation period, these were transformed into anecdotal records according to Henerson, Morris, and Fitz-Gibbon (1988). This 'procedure' allowed the observer to record the particular physical and verbal behavior of the workers, descriptions of their working environment, the details of production steps, and the norms of the managers and workers (Nieto-Montenegro, Brown, & LaBorde, 2004).

2.3. Individual interviews

2.3.1. Subjects

Each company (A–G) contributed a number of participants to the total sample ($N = 100$) that reflected company size (number of employees), the gender distribution and proportion of people who worked as pickers or packers. The final number of participants per company was A (16), B (2), C (12), D (14), E (6), F (21) and G (29). To accommodate company work schedules, a convenience sample of workers who were not busy at the time of interviews was invited to participate. The researcher, who did not know the workers, walked into the facilities and approached people from each of the existing workstations in the company. After hearing the purpose of the interview, the worker could decide whether or not to participate in the interview. This was repeated until the quota for that company was reached.

2.3.2. Interview instrument

Based on information from the direct observations and adapting some questions from relevant literature (Altekruse, Yang, Timbo, & Angulo, 1999; Angelillo, Foresta, Scozzafava, & Pavia, 2001; Bruhn & Schutz, 1999; Fein, Jordan Lin, & Levy, 1995; Meer & Misner, 2000; Unklesbay, Sneed, & Toma, 1998; Williamson, Gravani, & Lawless, 1992; Woodburn & Raab, 1997), a survey instrument (available upon request) addressing knowledge, attitudes and norms pertaining to mushroom food safety issues was developed to be completed in individual face-to-face interviews. To assure content validity, seven individuals with expertise in food safety and food microbiology reviewed the draft instrument. Their comments were incorporated into a revised survey instrument, which was translated into Spanish and pilot tested with mushroom workers ($N = 10$) in two mushroom companies to assure its clarity and accuracy and to practice the interview methodology. Comments and experiences were recorded and used to modify the instrument. The final survey instrument contained questions addressing five main categories in the following order: (1) workers' attitudes about rules and norms at work (i.e., handwashing practices, gloves, and hairnets); (2) attitudes/beliefs about microorganisms and their relationship with the environment, food, handwashing and foodborne illnesses; (3) evaluation of workplace facility cleanliness; (4) knowledge of food safety principles and foodborne illness; and (5) demographic information. Attitude and belief statements were evaluated using a five-point Likert-type scale (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree). Workplace facilities were evaluated using a 100-point scale (0 = extremely dirty, 100 = extremely clean). Each knowledge question was assessed using five multiple-choice options, where one option was 'do not know'. A final section contained open-ended questions designed to examine workplace norms and policies related to food safety and hygiene practices and procedures.

2.3.3. Instrument administration

One hundred instruments were administered using in-person oral interviews after obtaining informed consent. The interviewer read each question to the respondent, who recorded their answer on an answer sheet. Visual aids were used for all sections to help respondents understand the survey questions and indicate the answers of their choice. Culturally compatible analogies were also used to explain the mechanics of the interview and the scales used. Each interview of closed-ended questions lasted 35–75 min. The researcher chose a sub-sample of 20 individuals to answer the open-ended questions based first, on the workers' availability, and

second, on certain characteristics key to a successful interview. The researcher noted these characteristics (approachable, outgoing, respectful, decision making or leadership ability) during the observation period and/or the pre-interview process. Open-ended responses were tape-recorded. All participants completing the interviews received a $10 calling card.

2.4. Focus groups

2.4.1. Subjects

To avoid gender dominance, four focus groups were done with men only and three with women only. The sex of focus group participants from each company was determined using a drawing. Participants were recruited within each company without management involvement through a combination of workers' availability and interest and personalized invitations based on discussions with workers.

2.4.2. Focus group conduct

One focus group was conducted at each participating company ($N = 7$) according to Krueger (2000). The same moderator led all seven discussions during work hours and each group consisted of 6–10 participants. Groups were conducted using a script of open-ended questions with probes and were tape recorded for their analysis. The questions in the script explored the workers' motivation for following food safety rules including the role of incentives, worksite food safety norms and working environment and conditions. All focus groups participants received a $10 calling card.

2.5. Analysis

2.5.1. Quantitative data

Interview data were entered into an Excel™ (Microsoft, Redmond, WA) database, coded, compiled as descriptive statistics (frequencies, percentages, means, and standard deviations) and standard statistical procedures (inferential statistics t-tests and χ^2 tests) were conducted using SPSS 10 for Macintosh (SPSS Inc., Chicago, IL.).

2.5.2. Qualitative data

Data tapes were transcribed and then translated from Spanish into English for analysis. Using the constant comparative method (Glaser & Strauss, 1967), one researcher developed a list of thematic codes and subcodes for each sex that was applied to all focus group scripts. A second researcher then independently coded the transcripts using the coding list. Finally, the results were compared and any disagreements were resolved. A similar process was used for the open-ended interview data except coding categories were the same for each sex. One researcher wrote thematic summaries that were checked by the second researcher. Final themes and representative quotes were developed by consensus.

3. Results

3.1. Baseline food safety knowledge (see research question #1 in Table 1)

3.1.1. Interviews

Demographic characteristics of participants are shown in Table 2. Educational attainment was low. Participants' scores on the ten knowledge questions indicated inadequate baseline food safety knowledge (mean 5.01 ± 1.71), even though women attained a significantly higher mean knowledge score than men (5.44 ± 1.68 vs. 4.68 ± 1.67, respectively). Over 80% did not understand two basic concepts (people mishandling food cause most outbreaks; food containing harmful bacteria may not smell bad) and a third of participants (36%) did not connect pathogens with foodborne illness. Participants did not know the difference between cleaning and sanitizing. On the other hand, more than half of participants knew that humans were most likely to contaminate mushrooms and that heating food can kill bacteria. Almost all recognized that unwashed hands are the biggest source of bacterial contamination (93%). In the open-ended interview questions (and the focus groups), workers could list the personal hygiene rules they were expected to follow (wear hairnets, not chewing gum, wash hands after using the restroom) as well as the food handling rules. However, it was clear they did not understand the reasons behind the rules. Interviewees also confused food safety rules with product handling rules and/or occupational safety rules.

3.2. The normative system (see research question #2 in Table 1)

3.2.1. Interviews

Responses to the quantitative attitude statements used to measure norms generally followed a pattern of agreement with statements supporting good personal hygiene and company cleanliness and no significant difference between men and women emerged (See Table 3). But, there was also agreement that cleaning tasks were done to make the company look good in case an inspector visits and that cleanliness of restrooms reflected the company attitude toward hygiene. Workers generally agreed that supervisors served as role models for personal hygiene and showed commitment to keeping workstations clean but they were more ambivalent about coworkers being role models. In the open-ended questions, people reported that workers had good attitudes towards food safety rules and considered them

Table 2
Demographic characteristics of interviewed mushroom workers

Variable	Number of participants (percentage) [$N = 100$]
Company	
A	16 (16%)
B	2 (2%)
C	12 (12%)
D	14 (14%)
E	6 (6%)
F	21 (21%)
G	29 (29%)
Job position	
Packing	57 (57%)
Picking	43 (43%)
Sex	
Male	57 (57%)
Female	43 (43%)
Age	30.31 ± 11.46
Years working for the company	4.01 ± 3.71
Years in USA	8.54 ± 8.23
Education	
0–6 years	57 (57%)
6.1–9 years	23 (23%)
9.1–12 years	15 (15%)
Some college or bachelor degree	5 (5%)
Marital status	
Married	60 (60%)
Other	40 (40%)
Income	
$20,000 or lower	33 (34.7%)
$20,001–$30,000	55 (57.9%)
$30,001 or higher	7 (7.4%)
Origin	
Moroleón Area, Guanajuato	70 (70%)
Other Guanajuato State Areas	7 (7%)
Other Mexican states (8 different)	17(17%)
Other countries (3 different)	4 (4%)
USA	2 (2%)
Place of residency	
Kennett Square area, PA	82 (82.9%)
Delaware	14 (14.1%)
Other (Philly, Media, etc.)	3 (3%)
Housing	
On-site	22 (22%)
Off-site	78 (78%)
Number of people in the household	5.82 ± 2.79

important. Most workers stated that everyone should report possible sources of contamination to their supervisors. However, some workers indicated they would be unlikely to do this. Interviewees also reported that food safety training varied greatly across companies.

3.2.2. Observations

Cleanliness of restrooms and other worker facilities as well as worker hygiene did vary across companies.

Table 3
Mean scores of interviewed mushroom workers on food safety attitudes and norm scales

Variable	Worksite food safety norms and rules (N)	Attitudes/beliefs about food safety (N)
Chronbach's alpha[a] reliability coefficient (24 items)	0.7571	0.7759
Gender		
Male	3.39 ± 0.38 (56)	3.58 ± 0.45[b] (56)
Female	3.42 ± 0.37 (43)	3.78 ± 0.36[b] (43)

Scale: 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree.

[a] Chronbach's alpha is a statistical test used to evaluate if the items in the same section are interrelated and evaluating the same construct or idea.

[b] Significant at the 0.05 level ($p = 0.020$).

Hairnets were usually worn but sometimes not properly. Jewelry and fingernail polish were common adornments among women workers. Inconsistent enforcement of personal hygiene rules was noted and supervisor's poor Spanish speaking skills created a barrier to enforcement in some companies. Some supervisors and workers could serve as role models for personal hygiene and others could not. No efforts to promote good role models were evident in most worksites.

3.2.3. Focus groups

Both men and women were receptive to having food safety rules and could recite the personal hygiene rules they were expected to follow. They even agreed that it was important to follow the rules for their own sake and that of the company. But, enforcement was not uniform and mainly based on informal warnings to individual workers. Many complained that supervisors were not courteous when providing instructions or corrections, something very important for women workers (i.e., "More than anything that they would use manners and good words to tell you stuff, not being angry. They (supervisors) go to you and humiliate you in front of everyone. We do not like this, the way they sometimes treat us, because we work hard"). Workers were more willing to follow a supervisor's instructions if he/she used good manners while addressing them.

Workers complained that not everyone was willing to follow the rules (i.e., "Sometimes for only one bad person we all get in trouble"). Some delinquent workers cleverly followed the rules only at critical times and corrective actions were not applied. This created perceptions of inequity and unfairness and reduced worker interest in playing by the rules. Workers reported supervisors displayed favoritism in decisions about enforcing the rules and applying punishment for rule infractions. Some workers considered the decision to follow rules (especially personal hygiene) to be a personal matter and not the business of management or fellow workers.

Yet, some participants said that personal hygiene is important to protect the product (i.e., "Right now we are used to this (following the rules). We are conscious about what this is"; "There are some who like to eat with their hands dirty ... they like doing this"). In some companies, supervisors asked workers to report rule infractions but workers, especially women, were not willing to 'snitch' on co-workers, possibly because of retaliatory social pressures. So, food safety infractions seen by workers on the production floor were not communicated to supervisors and, as a result, supervisors were often not aware of issues and events on the production floor.

In contrast to the interview findings, focus group participants reported that good supervisor and worker role models for food safety were absent in worksites. However, workers thought that good role models would be helpful to insure compliance. Finally, the ability of supervisors to inform workers of proper food safety practices varied greatly across the companies, largely due to language barriers and inefficient communication channels.

3.3. The motivational system (see research question #3 on Table 1)

3.3.1. Focus groups

Expectancy (extra effort will lead to better performance). Workers perceived inequities in discipline and rule enforcement by supervisors and wanted this corrected. Not surprisingly, workers saw little reason to follow the rules when someone else got away with breaking them. Most blamed 'another worker' for any rule infractions. For instance, packers blamed pickers for any debris found in the boxes of mushrooms that were sorted into containers for sale while pickers blamed packers for not understanding the restraints on their job and the circumstances for picking imposed by the facilities. Little team spirit existed and, although individual workers could see some benefit to following the rules, this was merely part of the job, not something that could benefit the company as a whole. This lack of team spirit seemed to be partially due to language barriers and lack of communication channels between workers and management. Workers also indicated that supervisors treated them like children, not adults who might have ideas to contribute to improving the company. However, in one company, expectancy was high due to an outstanding supervisor who was considered very fair. He made it clear that if the workers performed well on the job, their position would be waiting for them after their yearly trip to Mexico. He also involved the workers in decisions by holding group meetings to discuss problems and corrective actions.

Instrumentality (good performance noticed and rewarded). Workers felt that supervisors who showed favoritism did not recognize good behavior (following the rules). Workers wanted recognition of good working habits and many felt their conscientious efforts to follow the rules were ignored. In most of these companies, workers felt that good performance would also not be rewarded, making it worthless to follow the rules all the time. In several companies, workers reported that something had been promised for hard work (a jacket or bonus) and then took months to materialize, resulting in worker cynicism and low morale. Morale was low in one company that had adopted a punitive point system to enforce food safety practices. In addition to feeling punitive points were not assigned fairly, workers felt this system focused on the recognition of infractions at the expense of positive reinforcement of desired behavior.

Valence (value placed on rewards offered). Most of these companies did not have a formal on-going incentive program. However, workers were aware of incentive programs in other companies due to their community networks. They could clearly separate quality incentives from tokens with little value. Quality incentives were different for each sex. Men mainly desired monetary incentives like paid holidays or better salaries (i.e., "... is that they would give us a little bit more money"), while women were more likely to appreciate symbolic incentives like diplomas or certificate of awards. However, both men and women wanted recognition for hard work and good performance from management (i.e., "That the owner would go there (the packing lines) and say this is for you because you work harder than anyone"). Valued incentives did not have to be expensive. In one company, employees valued access to extra work (to earn more money) and use of the company car for errands as rewards for good performance.

3.4. The belief system (see research question #4 on Table 1)

3.4.1. Interviews

Mean attitude/belief scores registered between "neutral" and "agree" for both sexes, although women had significantly higher scores than men (see Table 3). Respondents believed that following the personal hygiene rules and avoiding unsanitary practices, like skipping hand washing after using the restrooms or spitting, would prevent mushroom contamination. They agreed that eating food while working or sores on their hands could contaminate mushrooms. They also believed that humans can transfer bacteria that cause illness to food and cleaning chemicals that get on mushrooms might make people sick. Comparison of knowledge and attitude/belief responses to related questions revealed that the term 'bacteria' seemed to affect response. If the term 'bacteria' was in an attitude statement, this evoked a desirable response, despite poor knowledge of what

these do. In agreement with the knowledge questions, workers believed that cleaning is the same as sanitizing and that a food that smells or tastes normal would not cause a foodborne outbreak. In the open-ended questions, participants indicated that food safety rules were important for the sake of the company and consumers. Although most people expressed positive attitudes towards food safety, some reported there were 'bad apples' who did not believe food safety related issues were important.

3.4.2. Focus groups

Certain ideas emerged that contradicted the interview findings about beliefs and attitudes. Women actively complained about restrictions on eating candies or chewing gum in the packing room while working (i.e., "We want to chew gum and they do not allow us"). Workers expressed concern about cleaning/sanitizing chemicals and mushrooms chemicals, complaining about rashes. Despite responses to belief statements, workers expressed ignorance of the relationship between diarrhea and consumption of contaminated food and did not see foodborne illness as a real health threat. A male focus group participant indicated: "Well, there are always bad food or an overload because you ate a lot, and this will make you sick". On the other hand, women focus group participants indicated little concern about getting a foodborne illness: "It is nothing more than a diarrhea ...", "yes, diarrhea is normal".

3.5. The worksite environmental system (see research question #5 on Table 1)

3.5.1. Observations

These mushroom companies had the physical resources to implement food safety rules, i.e., the cleaning supplies and manpower. At some companies, workers were responsible for cleaning their workstation. Other companies had a crew hired to take care of the cleaning tasks. For example, workers at some farms move from picking site to picking site without cleaning because a cleaning crew follows. In some packing facilities, a specific crew cleans and sanitizes all the equipment after workers quit for the day. Worker follow through on clean up, routine safety practices and personal hygiene varied within and across companies. Floors and workstations ranged from littered to spotless. Restrooms varied in cleanliness and were non-existent in some picking facilities. Sufficiency of cleaning routines varied depending on the worker doing the job. Posters or signs that might inspire proper behavior were often not relevant to the mushroom industry and used poor Spanish creating a communication gap. For example, signs were posted at the growing farms showing out-of-date pesticide handling practices in vegetable fields.

3.5.2. Focus groups

Workers indicated the supplies and equipment needed to follow the food safety rules were readily available. Workers also were generally receptive to food safety rules, realizing that some were needed (i.e., "If they (management) say that we would have to wear it (hairnets) to pick mushrooms, we will have to do it. You are supposed to do it"). However, workers indicated that communication about rules and their reinforcement was poor and ineffective. Food safety training varied from seeing a video (with no other interaction) to listening to an outside consultant lecture once a year about the safety rules, and education was related to general food safety issues, not mushrooms safety problems. Some participants indicated—"Well a little bit of it (training) because he showed us a video, but it was not similar to the work we do"; "They just told me how to pick mushrooms I was never trained"; "We have always seen videos related to the meat packaging industry". In other companies, participants indicated—"They gather a group of people here in this room, they use drawings and posters about how we have to work"; "We have HACCP classes that are offered every two months"; "They give us a talk and also the written rules". Some received no official training at all and instead got a sheet of printed rules with no skill training or reinforcement. Here workers learn from one another—"The truth is that no one has taught us anything, we have all learned on our own". Some workers expressed a desire for food safety training and several even suggested an approach to use in their worksite. One participant suggested that food safety education would be more effective if the instructor provided the reasons for following the food safety rules, instead of just telling workers they have to do this or that.

Workers reported rule enforcement methods ranged from none to a punitive point system. Workers were particularly unhappy about the latter feeling that there was no real logic (that they could see) to how points were awarded. If sufficient points were accumulated, one could be dismissed from their job, i.e., "They (supervisors) give you a warning, then the next time a written warning, then at the third one you are done". Some workers also felt that the chain of command was not clear because different people keep track of different things, i.e., "When we get here in the morning, there is always a person (supervisor) checking that people are washing their hands"; "They (supervisors) do not say anything in that area". Despite complaints, workers liked the security of mushroom work (mushrooms grow all year round) and wanted to please company management (i.e., "The best part is to know that you are OK with the owners, to work knowing the boss considers you a good worker, so if you go to Mexico and come back your job will be waiting for you").

4. Discussion

4.1. Baseline food safety knowledge (research question #1 in Fig. 1)

It is not clear how knowledge affects practice in this sample, but other surveys, regardless of ethnic mix, found that level of education is related to food safety knowledge scores (Altekruse et al., 1999; Meer & Misner, 2000; Williamson et al., 1992; Woodburn & Raab, 1997). However, not understanding the role of pathogenic bacterial in foodborne illness or that their hands could be the source of pathogenic bacteria could lead to unsafe practices. Therefore, the educational intervention intended for this target audience should provide specific and basic information about food safety principles. This might impact their belief system and affect behavioral intent.

4.2. Normative system (research question #2 in Fig. 1)

Success of any intervention will depend on fair enforcement and courteous communication of rules by supervisors. Maintaining the rules will require supervisors and key workers to serve as role models. Supervisor cooperation and skills will be key to the success (or failure) of the food safety education program implemented. To insure cooperation, they should be involved in program development. To insure skills, they should participate in the food safety training and receive additional instruction in communication and management skills.

4.3. Motivational system (research question #3 in Fig. 1)

Another key program element would be to establish expectancy that improved performance will benefit the worker (by insuring continued company productivity and steady employment) and that workers receive recognition through an incentive system that provides something of value in an even handed manner. Again, management/supervisory involvement will be critical. Food safety performance incentives could make a difference in compliance but this incentive system must be carefully planned and structured to avoid misunderstanding and favoritism when the rewards are given to the workers.

4.4. Belief system (research question #4 in Fig. 1)

This educational intervention should provide information and the opportunity to discuss food safety issues in order to alter food safety related beliefs based on fallacies about eating on the job, food, bacteria, cleaning/sanitizing and foodborne illness. Establishing the relationship between contaminated food and foodborne illnesses is fundamental to understanding the other intervention objectives. Others have reported similar attitudes about foodborne illness among immigrants, i.e., "If we did not get sick in Mexico, why would we get sick here?" (National Restaurant Association, 2001). If people do not understand the relationship between food intake and diarrhea, then the restrictions placed on individuals by poverty, poor health, lack of food, clean water and sanitation as well as societal mores and taboos, can lead to acceptance of diarrhea as normal (Kaferstein & Abdussalam, 1999). Certain routine practices acceptable in their home society, where the food safety consequences are not understood, could have devastating food safety consequences in the workplace (Motarjemi, Kaferstein, Moy, & Quevedo, 1993). Altering their beliefs may affect behavioral intention.

4.5. Worksite environmental system (research question #5 in Fig. 1)

In many companies, training is not uniform or sufficient to support good food safety practices. Poor and inconsistent communication between supervisors and workers appears to contribute to lack of follow through and confusion about chain of command. Evenhanded reinforcement of rules could build on worker receptivity to clearly defined rules to improve food safety practices. There is a need to consult with supervisors to define appropriate communication channels, enforcement and reinforcement of rules. In addition, supervisors need to receive food safety training so all members of the food safety team are on the same page.

5. Conclusions

Although problems were evident among the companies, the proactive stance of management and worker's positive view of employment in the mushroom industry provides fertile ground for implementing a consistent food safety program. Use of the HAM and these three methods of assessment provided a more realistic picture of the situation in which these employees work than use of any particular method alone. Using three methods of assessment allowed triangulation of results to confirm or refute findings. The research questions (RQ) outlined in Table 1 were answered as follows:

RQ1 *Knowledge system:* Workers did not achieve good scores on the knowledge test, indicating poor understanding of the reasons why rules might be followed.

RQ2 *Normative system:* Scores on normative interview questions indicated socially acceptable agreement with good food safety practices. However, focus groups indicated rules were not necessarily followed and there was little social support among

the workers or from management to actively follow the rules. Few role models were evident. Supervisors generally were not even-handed in enforcing the rules and lack of courtesy contributed to poor worker morale. Observations generally confirmed that food safety practices were not consistently followed and that few role models existed.

RQ3 *Motivational system:* Focus groups revealed extra effort did not lead to team building and support of correct practices (expectancy low), that many workers felt 'following the rules' was not recognized or rewarded (instrumentality low), and that, if rewards were offered, these had little value to workers (valence low). Most companies did not have an active incentive program to increase motivation.

RQ4 *Belief system:* Socially acceptable responses on the interview belief questions did not agree with the findings from focus groups. Resentment of restrictions on personal behavior surfaced and misconceptions about cleaning and sanitizing, food spoilage and foodborne illness emerged. Their beliefs did not support connections between their personal actions and possible bad food safety outcomes.

RQ5 *Environmental system:* Observations indicated that infractions of food safety rules and behaviors were common. Physical resources were available to support sanitation but degree of cleanliness of worksite, restrooms and personnel varied across companies. Workers were aware of these resources and were receptive to following rules but training and communication about rules and their enforcement was generally poor. Most companies needed to create a more supportive environment for food safety practices.

Knowledge, attitudes, and beliefs that influenced the practices observed in this study are likely to be similar to those present in many other food production and processing facilities. The specific advantages of using HAM to design a needs assessment include (a) broadening an investigation to the social and physical environment in addition to just examining worker characteristics, (b) allowing data triangulation which can explain why something is or is not happening, and (c) exposing connections between the various players in the worksite. This model therefore has wide applicability to a variety of industry settings and thus can be used to develop food safety training programs for other production and processing situations.

This needs assessment does have limitations. It focused on the workers and gathered limited data on management through observations and the informal introductory meetings that were held at each participating company. Future work should include interviews with supervisors and other members of the management team. In addition, the sample size used in this project was small and may not be totally representative of the situation in all the facilities within the mushroom industry. The sample involved in the interviews and focus groups may not have represented the knowledge and views of all workers in participating companies. The number of focus groups was determined by funding and not by saturation of the data. Since the observer performed all the tasks in a company within a couple of days the observation period might not have been long enough to detect subtle patterns in workers behaviors.

Nevertheless, the authors believe that a HAM based needs assessment provides a sound basis for designing a food safety training program for Hispanic mushroom workers.

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