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Applying Learning Theory to Safety and Health Training for Hispanic Immigrant Dairy Workers

Patricia M. Juárez-Carrillo, PhD, MPH[1]
Amy K. Liebman, MPA, MA[2]
Iris Anne C. Reyes, MPH[3]
Yurany V. Ninco Sánchez, RN[3]
Matthew C. Keifer, MD, MPH[4]

We designed a safety and health curriculum for dairy immigrant workers aiming to increase knowledge, encourage safe behavior, and reduce worker communication inequalities to prevent occupational injury and diseases. The design is largely based on the Taxonomy of Significant Learning and incorporated behavioral and adult learning theories and principles of occupational hazard control. Trainings were implemented with 836 Spanish-speaking workers from 67 farms in Wisconsin. Sixty-seven percent of workers reported never being trained before in dairy safety, 65% of these worked in dairy for 5 or fewers years, and 26% of workers reported being ever injured while working on dairy. Quantitative and qualitative evaluation of the trainings suggest that our curriculum successfully increased worker knowledge and promoted contemplation of safe practices. The overall knowledge gain of 25% was statistically significant ($p < .01$). Workers recalled at least one key concept, expressed confidence of adopting at least one safety behavior, and mentioned their intention to communicate safety concerns to farmers. To our knowledge, this is the first Taxonomy of Significant Learning application to occupational safety and health education. Our curriculum can support dairy farmers' compliance with Occupational Safety and Health Administration's annual training requirements by providing our basic safety and health training to workers at early job stages.

Keywords: *immigrant; Hispanic; dairy farm; occupational injury and health; injury prevention; active participatory learning; curriculum; safety; bilingual; training; Spanish-speaking; worker*

INTRODUCTION

"Seguridad en las Lecherías: Immigrant Dairy Worker Health and Safety" is a comprehensive occupational safety and health intervention for immigrant dairy workers, implemented by the National Farm Medicine Center and Migrant Clinicians Network as part of the Upper Midwest Agricultural Safety and Health Center, a National Institute for Occupational

[1]*University of Texas at El Paso, El Paso, TX, USA*
[2]*Migrant Clinicians Network, Salisbury, MD, USA*
[3]*Marshfield Clinic Research Foundation, Marshfield, WI, USA*
[4]*VA Puget Sound Medical Center, Seattle, WA, USA*

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Safety and Health–funded effort. The project involved a randomized controlled study examining the application of the community health worker model to dairy settings, and the development of a safety and health train-the-trainer curriculum (Liebman, Juarez-Carrillo, Reyes, & Keifer, 2014). This article describes the curriculum development and evaluation with workers. Our project followed selected Strategic Goals of the National Occupational Research Agenda (NORA AgFF Sector Council, 2008) and recommendations by experts and federal agencies to design and evaluate occupational safety and health educational interventions for vulnerable populations (O'Connor, Flynn, Weinstock, & Zanoni, 2014). The curriculum aimed to increase knowledge, encourage safe behavior, and reduce worker communication inequalities to prevent occupational injury and diseases.

BACKGROUND

Immigrant workers are important to dairy production in the United States; immigrant labor accounts for 51 % of all dairy labor, and dairies that employ immigrants produce 79% of the U.S. milk supply (Adcock, Anderson, & Rosson, 2015). These workers are employed in one of the most hazardous industries. An average of 39 workers died per year while working with dairy cattle and milk production from 2008 to 2012 (U.S. Bureau of Labor Statistics, 2014a). Additionally, 6 injuries per 100 full-time dairy cattle and milk production workers occurred in 2012, almost twice than private industry average (U.S. Bureau of Labor Statistics, 2014b). In addition to injuries, workers are at risk of diseases transmitted through contact with animals and animal waste (Sobsey, Khatib, Hill, Alocilja, & Pillai, 2006). Immigrant dairy workers are largely Spanish-speaking and with low levels of literacy (Dyk, 2007; Harrison, Lloyd, & O'Kane, 2009). Researchers recognize immigrant workers may confront greater risks due to particular challenges, including language, personal and cultural belief systems, vulnerability due to undocumented immigration status, and other social and health determinants (Barker & Chappelle, 2012; Flynn, Eggerth, & Jacobson, 2015; Liebman, Juarez-Carrillo, Reyes, & Keifer, 2016; Schenker & Gunderson, 2013).

METHOD

Curriculum Design

The design was based on workers' context and perceptions, on learning and health behavior theories for adults, as well as on the foundations of exposure control of occupational hazards. The curriculum includes multiple and varied heuristic opportunities for workers self-learning as an alternative of lecturing or showing the information. The following sections detail our methodology to design the curriculum according to workers' context, theoretical background, and content of the curriculum.

Context. To understand workers' context and recognize common hazards on dairy farms, we conducted five focus groups with 37 workers, considered the directives detailed by the Occupational Safety and Health Administration (OSHA) Local Emphasis Program (LEP-009; OSHA, 2011), and conducted observations on 16 farms.

Workers' perceptions about safety and injury are published elsewhere (Liebman et al., 2016). In summary, they identified multiple safety concerns spanning individual, managerial, and environmental issues and highlighted immigration status as an occupational hazard. Workers recognized that injuries were frequent and that health care costs were covered mainly by them. Workers also reported limited knowledge on workers' compensation. Unknown hazards, distraction, fatigue, reduced use of personal protective equipment, and work pace pressure by the employer were mentioned as causes of injuries. Finally, workers recognized the joint responsibility of farmers and workers to reduce risks and prevent injuries.

Related to safety trainings, workers participating in focus groups unanimously agreed that training is essential to learn about working safely, especially because such information is commonly omitted during job trainings. One participant stated,

> They [the owners or bosses] never speak about the risks, they speak about how one has to clean the cows, how to milk and all that, but they never speak about the risks. ("*. . . ellos [los dueños o patrones] nunca hablan de los riesgos, ellos hablan de cómo uno limpie las vacas, de cómo ordeñe, y de todo eso, pero nunca hablan de riesgos.*")

Workers also recognized the need for producers to implement safety-related management practices including trainings, worker/management meetings, enforcement of safety practices, and the availability of safety information in Spanish. Finally, workers preferred face-to-face group sessions in Spanish with visual information requiring minimal reading that actively incorporates dialogue and opportunities to discuss concerns.

Theoretical Background. The curriculum design was largely based on the Taxonomy of Significant Learning (TSL; Dee Fink, 2013) and incorporated behavioral theory to promote changes, and considered adult learning theory and principles of occupational hazard control. Based on TSL, lessons included key safety information (foundational knowledge), provided opportunities to practice new skills (application of knowledge), and used personal stories to link injury safety knowledge, unsafe practices, and absent farm safety protocols (integration and connection). The curriculum also addressed health, economic, and social implications of being injured (human dimension); favored discussions on indirect consequences for workers, their family, and the farmer (caring); and encouraged workers to identify safe practices and ways to find safety information (learning how to learn).

To promote behavioral changes and address worker perceptions, the curriculum was informed by the health belief model, which proposes that behavior is influenced by perceptions of severity and susceptibility, benefits and barriers, and self-efficacy to achieve a desired behavioral change (Bandura, 1997; Champion & Skinner, 2008). At the end of each lesson, we emphasized the phrase "Yes, you can" and asked workers to identify actions they feel confident in doing to be safer at work, encouraging them to think about adopting safe practices and to stimulate contemplation of desired behavioral change.

The curriculum design was also informed by adult education theory (i.e., Andragogy; Knowles, Holton, & Swason, 2012) and incorporated experiential activities and exercises in which participants facilitate their own learning process. Each lesson included formative evaluation through diverse classroom assessment techniques (Angelo & Cross, 1993) such as background knowledge probes (e.g., What do you know about . . .?), empty outlines (e.g., a blind spot is . . .?), and think-pair-share activities (e.g., observe the photo, discuss with your partner, and then share with the group). Finally, we applied concepts of the occupational safety hierarchy of controls (U.S. Centers for Disease Control and Prevention, 2015) to help workers identify areas in which they could take part and areas of farmer responsibility. Key messages supported workers in understanding information on hazard elimination and substitution, administrative controls, and personal protective equipment.

Content. The curriculum (Table 1) is composed of five 1-hour lesson modules in English and Spanish. Each module includes learning objectives to help workers identify hazards and learn safe practices, background information, facilitator's guide, slide presentation, and supplemental materials. The background section is a reference with detailed information about the topic. The facilitator's guide describes step-by-step instructions matched to each slide. Each module includes varied participatory activities such as question-and-answer format, directed discussion, brainstorming and use of flipcharts, fictional and real stories, use of yes/no cards, hands-on exercises and demonstrations, jeopardy-like games, and interactive key point summaries.

While the facilitator must be able to read the curriculum, there are no literacy requirements for participants. The facilitator's guide includes simple wording and use of active voice to guide facilitators such as producers, supervisors, students, consultants, as well as workers with adequate skills and characteristics to train coworkers. The curriculum is specifically designed with the goal that once trained select trainees can use it to facilitate training for others. We did not evaluate the train-the-trainer component of the curriculum in this article.

The slide presentation uses colorful graphics and minimal wording and is presented via a computer and projector or printed on a flipchart binder. The binder presents slides that face workers while instructions are on back, facing the facilitator. Supplemental materials, including flyers, comic books and posters, were given to workers and producers during and after trainings.

The curriculum underwent iterative and rigorous reviews for content and cultural sensitiveness by staff experienced in formal and nonformal education and in occupational safety and health. Statements and messages adhered to limited readability levels. Moreover, each lesson was revised accordingly based on workers' feedback prior to full implementation.

Evaluation

We conducted quantitative and qualitative evaluation to assess the efficacy and adequacy of the trainings. Quantitative data were collected through individual workers' responses to pre and postassessments for all but the first lesson to examine participants' knowledge gains. The first lesson was deemed unnecessary to evaluate since it included a general overview of hazards on dairy farms. The assessments underwent significant revisions. After five rounds of piloting, the final version of assessments included five brief, multiple-choice questions with only one correct answer for each question. Table 1 lists the main topics tested. Answer choices included pictures, graphs, icons, or simple wording. Each question was also read aloud to the group. Workers completed their pre- and

TABLE 1
Dairy Worker Safety Training Curriculum Content

Lesson Number/Title	*Key Safety Messages*	*Readability Level[a] of English Version*	*Topics Tested Before and After Trainings*
1. Working safely in dairy	a. Animals, equipment, and machinery are the main causes of injuries, disabilities, and fatalities. b. Other hazards include chemicals, confined spaces and silos, electricity, falls, needle sticks, dust, noise, and repetitive movements. c. Workers' conditions, perceptions, and practices increase risks of injuries such as lack of experience on dairy farms, fear of job loss, language barriers, machismo, distraction, tiredness, and hurrying.	7.7	No assessment required because this lesson is an overview of general farm hazards and workers' challenges
2. Working safely with cattle	a. Lack of knowledge and inadequate practices on basic cattle behavior may cause injuries such as blind spot, flight zone, and point of balance, stressed and sick cattle, and aggressive bulls. b. Harms may happen by repetitive motions and ergonomic conditions. c. Increase communication among workers and between workers and farmers. d. Lack of hygiene can cause infectious diseases. e. Chemicals, medicines, and unsafe use and disposal of syringes can cause health issues. f. There is a need to address workers' perceptions and attitudes toward safety.	6.0	Cows' blind spot, stress signals, flight zone, needle disposal, handwashing
3. Staying safe with equipment and machinery	a. Higher risks are posed by tractors without rollover protective structures, and unshielded power takeoffs and other equipment with moving parts. b. Injuries happen by unsafe practices when driving tractor and skid steer such as incorrect entry/exit steps, not wearing seat belts, and mud/manure on the equipment. c. There is a need of protocols and enforcement of energy lockout and tag out. d. Hearing loss occurs if working with noisy machinery without noise protection. e. Prevent injuries with correct driving and hauling positions, taking breaks, and doing stretch-out exercises during long working periods.	6.8	Power takeoff, rollover protection systems, machine guarding, proper entry and exit of farm vehicles, energy lockout/tag out

(continued)

TABLE 1 (CONTINUED)

Lesson Number/Title	*Key Safety Messages*	*Readability Level[a] of English Version*	*Topics Tested Before and After Trainings*
	f. Risks increase by workers' conditions such as language barriers, unauthorized migration, tiredness, distraction, or hurried. g. Risks increase by workers' perceptions and attitudes such as machismo, normalization of risks, fear of job loss and deportation, and lack of knowledge.		
4. Worker rights and responsibilities	a. Workers' law protection can be enforced on farms with 11 or more employees in Wisconsin. b. Workers need to acknowledge OSHA's worker rights and protections. c. Risk can be reduced with farm's safety and health protocols and injury record keeping. d. Address misunderstandings about and lack of workers' compensation insurance. e. Increase communication between workers and dairy producers. f. Increase reporting injuries and diseases to farmer and medical personnel. g. Increase reporting the "return-to-work" plan to the farmer.	8.2	Worker compensation definition and benefits, OSHA enforcements and inspections, injury reporting
5. Working safely around chemicals, confined spaces, and silos	a. Chemicals are commonly used and originate in the farm and can be a health and environmental risk. b. Exposure factors that affect level of harms include dose/response, routes of entry, level of toxicity, individual characteristics, and behaviors. c. Inadequate handling, storing, and disposal of chemicals and medicines and lack of use of personal protective equipment increase risks of exposure. d. Lack of knowledge and poor management augment risks of confined spaces and silos. e. Provide bilingual safety data sheets and labels. f. Lack of protocols or poor management of emergency situations should be addressed.	7.7	Confined spaces, safety data sheets, personal protective equipment, entry routes of chemicals, emergency information

NOTE: OSHA = U.S. Occupational Safety and Health Administration.
[a]Flesch–Kincaid Grade Level, Microsoft Word.

postassessments anonymously with their results paired when possible. Qualitative evaluation included analysis of worker responses to three open-ended questions. Two questions were intended to understand workers' recognition of key messages and their perceived efficacy to conduct safety practices and one question to evaluate participants' satisfaction with the training. To promote worker responses, facilitators addressed the importance of workers voicing their concerns without fear of challenging or interfering with the facilitator or farmer practices. The open-ended questions included the following: (1) Of everything you learned today, what information affected you the most? (2) Based on what you learned today, tell us one action you plan on doing to keep yourself safer at work. (3) How can we improve this presentation for other workers? Please provide at least one example. The facilitator asked the questions aloud to the group and noted responses.

Participants

We primarily recruited Wisconsin dairy farms (herd size of at least 400 cows) identified as Concentrated Animal Feeding Operations by the Wisconsin Department of Natural Resources (2012). Recruitment methods included phone calls, mailed postcards and brochures, word of mouth, and snowball techniques, offering free on-site training lessons in Spanish for workers. Inclusion criteria included having at least three Spanish-speaking workers per farm. Self-selected farmers signed consent before activities were implemented. Two fully trained, bilingual, and experienced outreach workers from National Farm Medicine Center facilitated the trainings. Trainings were mainly facilitated between shifts, and producers or supervisors selected the day, time, and workers to attend. Workers verbally consented their participation before trainings. They were asked to print their full name on sign-in sheets for the producer's records and anonymously provide their demographic information for research purposes. Workers were paid by their employers at their normal rate for the time in training. All research activities were approved by the Marshfield Clinic's institutional review board (KE110311D).

Analysis

Demographic and assessment data were collected in Spanish. Data were managed using REDCap© (Research Electronic Data Capture) software and analyzed with SPSS, SAS Enterprise Guide 7.1, and Microsoft Excel 2010. We conducted descriptive and correlation analysis of the demographic information, paired *t* tests to determine knowledge gains, and open coding to identify the main themes from worker responses to open-ended questions.

RESULTS

Overall, 836 workers from 67 farms in 37 Wisconsin counties participated in worker training between 2012 and 2015. Farms had an average of 1,277 dairy cows ($N = 55$) and 20 employees ($N = 55$). About 62.7% of the workforce were Hispanic ($N = 55$), 13.9% of which were women ($N = 54$). Producers reported that a majority of their immigrant workers (80.5%) had difficulty speaking or reading English ($N = 54$; data not shown).

All workers participated in at least one training session with an average of 12 workers trained per farm. Generally, dairy producers requested training to be 3 weeks apart and in the early afternoon during a work shift. Sometimes, lessons were divided into multiple sessions to keep the class size manageable or according to the demands at the farm. Fifty-eight farms completed all five lessons in an average period of 63 days (range 1-147 days). Facilitators took an average of 57 minutes to complete each lesson and had an average class size of eight workers (data not shown).

We collected demographic information from workers before the trainings (Table 2). Workers were largely male; were originally from Mexico; had a mean age of 32.2 years, with the highest proportion of workers (43%) between 20 and 30 years of age; and had 8.3 years of education. Workers reported a 5.5-year tenure on dairy farms and living in the United States an average of 8.8 years. An overwhelming majority preferred to learn about safety in the Spanish language.

Related to prior training and work-related injuries (Table 2), about two out of every three workers reported never being trained in dairy safety, 65% of these worked in dairy for 5 or less years. In all, 26% of workers reported being injured while working in dairy and a slightly lower proportion of female workers (29%) reported prior training than male workers (34%). The highest proportion of workers reported ever being injured were between 31 and 40 age years and averaged 6- to 10-years working in dairy (36%). More women than male workers (34% vs. 25%) reported being injured. Significant association was found between ever being trained and the number of years working on dairy, number of years living in the United States, and ever being injured while working on dairy ($p < .01$).

To test the effectiveness of our curriculum, we conducted paired *t* tests analysis with the assessments of 338 workers on 39 farms. Challenges with timely

TABLE 2
Demographic Information of Workers Participating on Trainings

Category	*Frequency/*M *(% or* SD *and Range, if Applicable)*	*Prior Dairy Safety Training,* n *(%)*			
		Yes	*No*	*Chi-Square*	p
Prior safety training (*N* = 771)	—	255 (33)	516 (67)	—	—
Gender (*N* = 765)				.87	.35
Male	659 (86)	223 (34)	436 (66)		
Female	106 (14)	31 (29)	75 (71)		
Age (years, *N* = 763)	32.2 (8.5, 18-63)			10.07	.04
18-20		7 (19)	30 (81)		
21-30		95 (29)	232 (71)		
31-40		100 (38)	166 (62)		
41-50		43 (39)	67 (61)		
≥51		7 (30)	16 (70)		
School years (*N* = 729)	8.3 (3.4, 0-22)			1.45	.69
No school		6 (24)	19 (76)		
1-6		69 (30)	165 (71)		
7-12		141 (33)	290 (67)		
≥13		13 (33)	26 (67)		
Country of origin (*N* = 764)					
Mexico	682 (89)	231 (34)	451 (66)		
Central America	76 (10)	22 (29)	54 (71)		
United States	6 (1)	1 (17)	5 (83)		
Language preferred to learn (*N* = 734)					
Spanish	705 (96)	231 (33)	474 (67)		
English	29 (4)	13 (45)	16 (55)		
Years living in the United States (*N* = 761)	8.8 (5.9, <1-50)			22.72	<.01
<1		6 (12)	44 (88)		
1-5		59 (30)	138 (70)		
6-10		92 (36)	166 (64)		
≥11		95 (37)	161 (63)		
Years working on dairy (*N* = 756)	5.5 (4.7, <1-40)			44.42	<.01
<1		16 (14)	99 (86)		
1-5		92 (28)	232 (72)		
6-10		92 (43)	122 (57)		
≥11		48 (47)	55 (53)		
Ever being injured while working on dairy (*N* = 762)				18.41	<.01
Yes	204 (26)	90 (45)	109 (55)		
No	570 (74)	161 (29)	402 (71)		

attendance prevented us from obtaining either or both the pre- and postassessments from some workers. From the paired comparison, there is significant difference in mean scores between pre- and posttraining tests for each lesson ($p < .01$; Table 3).

Pretraining scores show workers' limited knowledge about workers' rights and responsibilities (60.4%) and animal handling (60.9%). Similarly, workers reported limited knowledge on risks with machinery and equipment (66.4%). In contrast, workers resulted

TABLE 3
Pre- and Posttraining Results per Lesson

			Scores (Paired t Tests)					
				Pre		*Post*		
Lesson	*No. of Farms*	*Average Workers per Lesson (Range)*	N	M	SD	M	SD	p
2	32	13 (2-27)	388	60.9	19.6	73.5	16.7	<.01
3	35	10.5 (3-24)	334	66.4	22.3	86.7	16.8	<.01
4	38	11 (3-31)	383	60.4	18.0	82.3	16.2	<.01
5	39	9 (2-25)	388	75.4	18.5	86.8	17.1	<.01
All lessons (2-5)				65.8	20.5	82.2	17.5	<.01

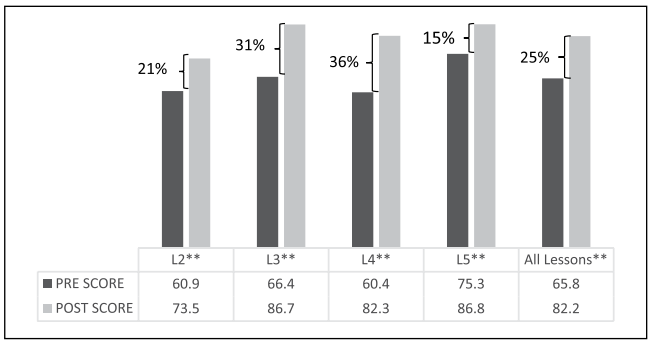

FIGURE 1 Average Scores and Paired *t* Test Knowledge Gains
$^{**}p < .01$.

with higher pretraining scores about chemicals, silos, and confined spaces (75.3%).

After trainings, the overall knowledge gain of 25% was statistically significant ($p < .01$), with 21%, 31%, 36%, and 15% knowledge gains on Lessons 2 through 5, respectively (Figure 1). The lesson on workers' rights and responsibilities resulted with the highest knowledge gain. Deeper analysis of the posttraining tests suggest that some questions were difficult for workers to answer. Concepts difficult to grasp by workers included cattle behavior, gastrointestinal disease prevention through handwashing, and safety practices when driving tractors and skid steers. Workers also had difficulty recognizing their responsibility on reporting work-related injuries to health care providers and to understand that workers' compensation regulation applies differently on each state. Finally, workers had difficulty identifying confined spaces and the personal protective equipment when handling chemicals.

Analysis of the open-ended questions and feedback from workers indicates that nearly 100% of the trainings met the learning objectives. Participants were able to note at least one key concept they learned, at least one behavior they felt comfortable incorporating into their work, and the intention to request meetings with management to communicate their concerns. General suggestions included the inclusion of on-site walkthroughs and to practice safety actions during the trainings to learn better the safety recommendations. Others requested additional advanced safety topics. Overall, workers qualitative evaluation show they felt empowered to carry out at least one safe practice and to request meetings with the farmer to communicate their concerns.

DISCUSSION

The concepts of the TSL and other theories were successfully applied to the design and implementation of our safety and health curriculum. Knowledge gains were significant for all lessons, and participants demonstrated contemplation of safe practices. To our knowledge, this is the first application of this taxonomy to occupational settings.

Of concern are the pretraining scores showing workers' limited knowledge on animal handling and safety, particularly when the majority of immigrant workers are hired for tasks with regular and proximal contact with cows and by the high frequency of injuries caused by cattle during milking and animal handling in dairy farms (Boyle et al., 1997; Douphrate et al., 2013).

The difficulties in answering correctly some concepts related to animal handling call for more trainings to reinforce knowledge and safety practices and to

review the testing tools and processes. The pretraining scores and workers comments also indicate higher need and interest to learn about their occupational rights and responsibilities.

There were several limitations regarding the design, assessment, and implementation of the curriculum that could affect knowledge gain rates and the sensitiveness of our test results. Main challenges were time limitations, farm demands, and worker behavior and attitudes. We prioritized the amount and depth of the content to 1-hour lesson modules with basic key concepts and omitted some hands-on and on-site activities to comply with farmers' management needs and demands. Some trainings started late, were postponed, were conducted at an accelerated pace or skipped activities due to seasonal demands, or were interrupted by producers to pull select workers out to resume farm tasks. Dairy work is labor-intensive with typically long shifts that may result in fatigue, precluding workers from concentration and engagement in learning. Other workers appeared hesitant or fearful to answer demographic and test questions, were observed copying answers, and were distracted with their mobiles or disinterested. Some managers attended the training to supervise workers, which may have affected the workers' easiness to participate actively or ask clarifications. Also, due to varied worker literacy levels, facilitators needed to repeat or adapt the information, slow the pace, and provide individualized support to answer demographic questions and tests.

The wide variability on the completion of the curriculum (i.e., 1 to 147 days apart) exposed workers to varied opportunities to promote their contemplation and confidence to practice safety; some workers were exposed to timely reinforcing reminders while others had reduced opportunities to receive frequent reminders. The physical learning environment varied widely, which may have influenced both delivery and comprehension of information for certain workers, varying from cold machine sheds to air-conditioned conference rooms, food availability, or children brought by some workers. These conditions and limitations should be considered for future farm-based informal education.

The variation between knowledge gains measured through paired *t* tests and the positive evaluation by workers suggest that written tests must be applied carefully and results taken cautiously with this population as per the limitations described above. Time constraints prevented facilitators from providing participants individual pre- and postscores; however, facilitators addressed the correct answers to the group as a whole at the end of each session as time allowed to promote brief group discussions and clarify doubts.

More research is recommended to examine immigrant worker behaviors and perceptions toward safety and the likelihood of being injured according to gender, age, education, migration status, and work experience. Also, future projects could evaluate distinct concepts of the theories used in this curriculum to identify specific impacts on the learning process.

Workers' comments about their confidence in conducting safer practices in the future and the fact that participatory techniques produce greater knowledge gains and behavioral changes than passive techniques (Burke et al., 2006) make us conclude that behavioral changes may occur among workers in the future. To examine this further, the *Seguridad* project is collecting data about workers' safety practices over a 12-month period to be published at a later date.

Our curriculum covers numerous basic safety concepts to set the baseline for future advanced trainings with more hands-on demonstrations. Designed for Spanish-speaking immigrant workers, this curriculum adds a new and evaluated educational model to other resources available for dairy farms (U.S. Agricultural Safety and Health Centers, 2015; University of California–Davis, 2010). Collective learning encourages groups to promote changes, enhances communication between workers and employers, and supports groups negotiations for worksite improvements (Bunniss & Kelly, 2008; Bunniss, Gray, & Kelly, 2012; Hager, 2011; Iskander & Lowe, 2013). Thus, advanced training curriculums could include activities to promote collective learning and self-efficacy (Bandura, 2002), such as developing joint action plans between dairy workers and dairy producers.

To promote further utilization of the curriculum, we recommended participant producers encouraging their workers and supervisors to become trainers of new employers or to repeat the trainings as needed. The curriculum is available on several websites. The project disseminated information to access the curriculum via social media, at regional and national conferences, via OSHA's website, and through partnerships with regional groups including the Professional Dairy Producers of Wisconsin, Puentes/Bridges—a nonprofit organization in the Western Wisconsin area—the Center for Dairy Farm Safety at the University of Wisconsin–River Falls, and the Mexican Consulate in St. Paul, Minnesota.

Finally, the inclusion of participatory and culturally sensitive approaches, and mentioning producers' managerial safety needs in our curriculum, aligns with the recommendations of occupational experts to empower underserved workers to practice safety (O'Connor et al., 2014).

CONCLUSION

To our knowledge, this is the first application of the TSL to agricultural and occupational safety and health education. Results suggest that this taxonomy, along with behavioral and adult learning theories, successfully increased worker knowledge and promoted contemplation of safe practices. Further research can inform TSL specific impacts on learning and promoting safety and health behavioral changes. This model could be applied to other occupations.

Results indicate the need of timely worker safety training. Despite that most workers had been working in dairy for 5 or less years, two of every three workers reported never having received prior safety training. This is contrary to OSHA's annual training requirements for many agricultural activities (OSHA, 2015) and confirms the findings by Liebman et al. (2016) wherein workers report receiving trainings on farm tasks but not on safety. To support dairy producers' compliance with OSHA requirements, our curriculum can be used to reach out to dairy workers with the characteristics described on this article. Workers' evaluations suggest that they felt empowered and willing to learn about safety and adopt safety practices, as one worker stated, "I am not here for the boss. I am here for me" ("*yo no estoy aquí por el dueño. Yo estoy aquí por mi*"). This face-to-face participatory curriculum offers an important tested tool to support producers in implementing safety and health training to immigrant and inexperienced Spanish-speaking workers at early job stages. The bilingual curriculum "Dairy Worker Safety Training" has OSHA approval through the Susan Harwood Training Grant SH-24887-SH3 (A. Saldana, personal communication, September 14, 2015) and is now available free of charge (Migrant Clinicians Network, 2015).

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