Feedback facilitates transfer of training with US Hispanic workers in a healthcare laundry linen facility

Angela R Lebbon,[1] Sin Chien Lee,[2] Douglas A Johnson[2]

[1]Department of Economics and Business, Lehman College, City University of New York, Bronx, New York, USA
[2]Western Michigan University, Kalamazoo, Michigan, USA

Correspondence to
Dr Angela R Lebbon, School of Business, State University of New York, New Paltz, 1 Hawk Drive, New Paltz, NY 12561, USA; lebbona@newpaltz.edu

Received 23 March 2015
Revised 10 June 2015
Accepted 22 June 2015
Published Online First 14 July 2015

ABSTRACT

Background This study aimed to increase safety knowledge and behaviour of US Hispanic custodial workers in healthcare through a culturally appropriate training and monitoring process.

Method A single-group, repeated-measures, pre-test and post-test design was used to examine training effectiveness across four sets of behaviours with 23 Spanish-speaking workers.

Results Small group, lecture-style training in Spanish with pictures and video resulted in significant improvements in knowledge and behaviour. However, additional analyses show that behavioural feedback was the critical component in improving safety behaviour during transfer of training.

Discussion Findings from reaction, knowledge, behaviour and results measures suggest that group training and graphic feedback is culturally appropriate and effective with Hispanic workers. Further investigation is needed to understand cultural factors that facilitate effective development and delivery of safety training and feedback to US Hispanic workers.

BACKGROUND

The majority of safety literature on foreign-born US Hispanic workers recommends development and delivery of training that addresses language, educational and cultural differences.[1–4] However, little guidance is provided on how to specifically address those differences. The most well-known research on cultural differences comes from Hofstede,[5] who originally defined culture across four dimensions. According to recent data collected on Latin American countries' dimensions,[6] Mexico's scores, for example, are dramatically different from US scores on *power distance*, *individualism* and *uncertainty avoidance*. These dimension differences between US and Mexico may indicate that US organisational training is less effective for foreign-born Hispanic workers than US-born workers. Research has found that Hispanics prefer learning in groups, want information and rules to guide their behaviour, work to receive external reinforcers and prefer social interaction to independent thinking.[7] Regardless of data describing these cultural differences, the safety literature rarely refers to these factors when describing the development and delivery of safety training to Hispanic workers. Therefore, this study attempted to address some cultural differences with Hispanic workers by developing and delivering a more culturally appropriate training and monitoring process.

Development of training

A necessary and important factor in the development of effective training is a systematic assessment of the organisation's needs to guide creating, implementing and evaluating a training programme; however, the use (and subsequent communication of implemented assessments) is scarce in the research literature, with only 6% of studies implementing and reporting such information.[8] In the field of behaviour analysis, assessments of organisational, task and people factors are frequently conducted to identify work behaviours and conditions that lead to performance deficiencies. However, culture, language and technology are not frequently assessed to determine potential influences on training, observation and feedback.[9 10] The Performance Diagnostic Checklist (PDC)[11] is one such assessment that serves as guide for developing optimal interventions and measurement systems. One limitation of the PDC involves the absence of questions around learner characteristics that may affect training or transfer, such as cultural differences and constraints related to language, literacy and technology. Therefore, the current study will attempt to fill this void by modifying and expanding the PDC to include cultural and learner characteristics, and will report the assessment questions and results that influenced the development of the current safety training and evaluation process.

Evaluation of training

Despite the vast literature on safety interventions with Hispanic workers, studies documenting behaviour change or reduction of occupational injuries among Hispanic workers are limited.[12] Organisations and researchers are predominately evaluating training with reaction measures; reporting of behaviour and results remains the least reported analysis.[8 13–15] Given that reactions are not reliable measures of knowledge and skill acquisition,[16 17] the evaluation of behaviour change is a key component for demonstrating transfer of training.[12] Ongoing behavioural observations are frequently used in behaviour-based safety to track behaviours, evaluate the effectiveness of improvement efforts and provide contingent feedback.[18] Feedback is another component in training programmes that may influence effectiveness and may change future reporting of evaluation measures.[13] More specifically, it has been noted that while "learning and behavioral criteria are conceptually linked, researchers have had limited success in empirically demonstrating this relationship"[8] (p. 235). It is entirely possible that feedback (either during training, testing and/or transfer of training) facilitates learning and transferring of training. Behavioural feedback has been shown to substantially enhance the effects of training,[19] especially when it is delivered in the typical manner: orally in coordination with goals, rewards and/or award ceremonies.[20]

To cite: Lebbon AR, Lee SC, Johnson DA. *Inj Prev* 2015;**21**:404–414.

A series of research studies conducted on Hispanics' workplace safety demonstrated the impact of individualised computer-based training (CBT) and testing in Spanish through measurement of reactions,[21 22] knowledge acquisition[21–23] and behaviour.[22] Feedback served as a component of the training, wherein participants received test questions and feedback after a set informational training slides.[22 23] If the participant did not correctly answer a test question, the answer was noted as incorrect and the participant was sent back to the training slide; advancement through the training was not allowed until all questions were correctly answered. Unfortunately, analyses were not conducted to separate the effects of training and feedback to determine which component had a greater influence on learning and behaviour.[22 23] The methodologies from these studies can also be expanded by (a) using a variety of test questions beyond multiple-choice or dichotomous options; (b) changing the phrasing and order of the test questions to prevent practice effects; (c) including reaction measures of self-esteem and work confidence and (d) evaluation of training with injury and financial outcomes. Furthermore, while CBT is an effective method for improving Hispanics' safety knowledge and behaviour, it is not always a practical, adequate, cost-effective solution for small businesses. Feedback methods that are delivered orally with rewards are highly effective, but they require effort, skill, time and money. Other empirical studies have found that delivering graphic feedback alone can yield significant changes to behaviour.[24 25] While there is a wealth of literature demonstrating the benefits on individualised instruction and feedback, this body of literature is largely conducted on Caucasian workers and college students raised in the USA.[23 26] Therefore, analysis is warranted to examine the effects of group feedback (ie, delivered graphically without goals or rewards, and only during transfer of training) on US Hispanic workers' safety behaviour.

METHOD

Participants and setting

Participants were 23 Spanish-speaking employees from a small healthcare laundry and linen facility located in Midwestern US. Employees were administered a survey in Spanish to obtain demographic information (see table 1 for results).

Table 1 Employees' demographic information

	Per cent (n)
Country of birth	
Mexico	95 (21)
Guatemala	05 (1)
Best spoken language	
Spanish	100 (22)
Language spoken at home	
Spanish	91 (20)
English/Spanish	09 (2)
Highest level of education	
6th–8th grade	71 (15)
9th–12th grade	19 (4)
Some college experience	10 (2)
Country of education	
Mexico	86 (19)
Guatemala	5 (1)
USA and Mexico	9 (2)*
	Mean (range)
Average age	44 (27–64)
Average years lived in the USA	19 (2.5–42)
Average years worked in linen industry in the USA	08 (0.6 –17)
Average years worked at the location of study	07 (0.6 –14)

Number of participants is in parenthesis next to percentage.
One participant was absent the day the survey was administered.
*These participants both received 4 years of US education.

Experimental procedures

This study employed a single-group, repeated-measures, pre-test and post-test design across four sets of behaviours to examine the effects of four different training delivery methods. Baselines of differing durations were used to decrease the probability that any observed behaviour changes could be attributed to coincidence alone. The four sets of behaviours (moving carts, handling linens, generic behaviours and environmental conditions) served as primary dependent variables since they were identified in the safety assessment as critical activities leading to injuries. The independent variables were the method of training delivery (spoken, written, with pictures, with videos), the type of language used to conduct safety training (English and Spanish) and behavioural feedback.

Repeated measures involved observation of employees' safety for 68 days over the course of 4 months; observations were conducted approximately three times per week for 90 min each observation. The total number of behavioural instances observed during the 68 days of observation were 3723 for carts, 4398 for linens, 3792 for generic and 5422 for environmental. Safety behaviour was averaged each day from these instances and reported as percentage safe for each behaviour set.

Safety assessment

Prior to starting the study, the research team toured the facility and interviewed the facility's general manager, lead production supervisor and production supervisor. The PDC[11](p.340) and Behavioral Analysis Worksheet[27](p.197) were combined and modified, then used to identify organisational, people and task factors affecting safety (see figure 1 for the list of questions) in order to develop a targeted safety intervention. Overall, the assessment questions revealed that information, knowledge, behaviour and consequences were not supporting safety (see figure 2 for a summary of the assessment results).

After the tour and interviews, a review of the facility's injury reports was conducted on the previous three years to gain information on work conditions and behaviours associated with injuries. Reported injuries were analysed by injury type, body part, work activity, whether the injury was Occupational Safety & Health Administration (OSHA) recordable or not. Analysis revealed the top 3 types of injury were oedema/swelling, strain/sprains and bruises/contusions. The body parts most frequently injured from the top 3 injury types were arm/elbow, hand/finger, leg/knee, groin, back and wrist. The top work activities resulting in injury included moving carts, catching/pulling/folding/sorting linens and blankets, being struck by/against carts or work materials, and dropping work materials.

Behavioural safety process

A behavioural safety process was developed to address some of the shortcomings and deficiencies identified by the safety assessment, which included improving information, knowledge, behaviour and consequences. The behavioural safety process was developed to address the following:

1. Shortcomings in information: (a) Transcribe safe body mechanics associated with work activities associated with

Safety Assessment Questions[1]

Information

- What safety procedures were employees trained on upon hire? Through employment?
- How often are employees retrained on safety behavior? Which safety behaviors?
- Are there written descriptions of safety behavior explaining exactly what is expected?
- Have employees received instruction on body posture and ergonomic behaviors related to tasks?
- Reminders to prompt safe behavior while engaging in the tasks?
- Is the supervisor present during task completion?
- Are there challenging and attainable safety goals?
- Are employees encouraged to hurry to meet production deadlines/goals?
- Are employees instructed to do the job incorrectly?
- Are there signs to prompt safe behavior?
- Do employees have a checklist to refer to on-the-job (or could one have been provided)?
- Are written safety materials presented in English or dominant/preferred language?
- Is training in English or dominant/preferred language?

Equipment and Processes

- If equipment is required, is it reliable? In good working order? Ergonomically correct?
- Is the equipment & environment optimally arranged in a physical sense?
- Are these processes arranged in a logical manner, without unnecessary repetition? Maximally efficient?
- Are there high-risk activities, tasks, and/or areas?
- Are there barriers that prevent employees from performing tasks safely?
- Are knowledge tests delivered on a computer or paper or verbally?

Knowledge

- Can employees tell you how to perform the task safely?
- Do employees know how engaging in unsafe acts affects their personal safety?
- Is testing for mastery of knowledge in English or their dominant/preferred language?
- Does the employee have the knowledge of computer functions for CBT?

Behavior

- Can the employee physically demonstrate the task safely?
- Do other employees routinely model the unsafe behavior to complete tasks?
- What was the unsafe act that resulted in an incident/recordable?
- What was the safe act that could have prevented the incident?
- Do employees rotate tasks to prevent fatigue? How often?
- Do employees have the skills of computer functions for CBT?

Outcomes

- What effect does performing the unsafe act have on employees' compensation or career?
- Do the employees receive compensation for work behavior other than safety?

Consequences

- Are consequences delivered contingent on safety behavior? (Frequency/immediacy/probability/ + or –)
- Do employees see the effects of their unsafe behavior? (How? Natural / arranged)
- Is there monitoring of safety performance? (Self / supervisor direct / supervisor indirect)
- Is there a response effort associated with performing safety?
- Are there other behaviors competing with the desired safe behavior?
- Do supervisors routinely provide corrective action for employees who engage in unsafe behaviors?
- Do supervisors and/or peers routinely provide positive feedback for safe behaviors?
- Do employees see graphed safety data for the group and/or individually?

1 These questions are replicated and/or modified from Austin (2000) and McSween (2003)

Figure 1 Assessment used to identify organisational, people and task factors affecting safety.

injury; (b) a task analysis of each work activity, which involved breaking down each activity into the smallest behavioural components; and (c) development of observational checklist.

2. Deficiency in knowledge and behaviour: (a) customised workplace safety training; (b) train employees on the identified, critical activities and work conditions; and (c) train and test Hispanic workers in Spanish.
3. Absence of consequences: (a) ongoing behavioural observations by researchers to assess safety behaviour; (b) deliver graphic, behavioural safety feedback; and (c) survey to understand workers' experiences with behavioural safety training.
4. Equipment and processes: (a) deliver training in-person via verbal and written lecture presentation, and deliver testing on paper, instead of CBT, given the limited knowledge, skills, resources and budget related to computers and buying modified computer equipment.
5. Cultural factors of Hispanic participants: (a) deliver training in small groups, only with other Hispanics, to appeal to collectivism and encourage questions and discussions; (b) developed rules for safe and unsafe behaviour and practices to address uncertainty avoidance; and (c) deliver feedback to appeal to power distance and the preference for use of information to guide performance.

Development of observation checklist

The observation checklist used to score employees' safety was developed from the safety assessment's identified critical behaviours and conditions. The two-sided, single-page checklist (see figure 3) consisted of a list of behaviours and associated columns allowing observers to quickly note the engagement of safe and unsafe behaviours (front page of checklist), and a list of safety definitions for the behaviours and conditions as a reference for the observers. Safety definitions were written based on

Safety Assessment Summary

Information. New employees receive safety training before they are allowed to work but little information is presented to employees regarding safety practices for body mechanics. Since the laundry linen facility is a sub-organization of a local hospital, participating employees are administered the same training as the hospital employees. The training content is delivered annually (but remained unchanged across the years), and consists of topics such as blood borne pathogens, chemical hazard standards, and emergency action plans. Although these are important considerations, they bear little relevance to the participating employees whose primary job duties involved handling linens and moving linen carts. Employees have standard operating procedures for all machinery (in addition to lock out/tag out policies and other machine safety procedures) but are not provided a handbook of those written safety procedures, nor are signs or checklists regarding body mechanics; safety training occurs largely on-the-job by observing a more experienced co-worker (i.e., 2-day job shadow). Supervisors are present during their work but provide goals and feedback related only to production and quality of production.

Equipment and Processes. Processes are arranged in a logical manner, table heights recently adjusted for optimal safety, and physical space in hallways can become limited depending on number of carts in use. Most carts are old and the steel bars installed on the carts result in heavier, difficult-to-maneuver carts. Additionally, some of the safety pins are broken and employees need a wrench to pull out the pin before they can push the cart. A commonly communicated safety concern among management and employees was musculoskeletal strain caused by pushing/pulling carts or heavy linens continuously for long hours. Lastly, the facility only had 1 employee-sanctioned computer to deliver their hospital safety CBTs (due to a perceived lack of need, especially given the budget needed for more), resulting in time-consuming delivery.

Knowledge. Employees were unable to communicate safe body mechanics related to their work tasks, but understood the importance of workplace safety and safe body mechanics. The hospital CBT is delivered in English, and some employees do not have knowledge of computer functions; it was communicated that a number of the employees were not computer-literate and required aid to complete the CBTs, both with reading the training and testing materials, and manipulating the materials via computer navigation.

Behavior. Employees were not observed safely demonstrating body mechanics related to work tasks, and as a result, employees are watching and modeling the unsafe behavior of more experienced co-workers. Another commonly communicated safety concern the linens, wherein an average load weighs 200 lbs dry. For example, thermal blankets can be heavy, especially when they are damp. The tangling of linens requires employees to exert more energy from both arms to untangle, such pulling and untangling behavior can put strain on employees' arms, shoulders, and back after repetitive actions for long periods of time; this also applies to employees transporting linens to washing machines/dryers. Repetitive movements of bending down to transport linens from the cart to the washer or vice versa, combined with pushing carts that are difficult to maneuver, may lead to strains and musculoskeletal disorders in the future. Task rotation can occur every 2 hrs to alleviate body stress, however, this is not a routine practice, nor common. Furthermore, injuries or pains associated with pinching and grasping movements have been reported frequently as well. Employees assigned to folding or ironing typically engages in pinching and grasping movements throughout their shift, possibly affecting musculoskeletal function in fingers, hands, and arms. The hospital presented issues for management during the delivery of the hospital training given that some employees are not computer-literate and required management to sit next to them during training to navigate the training and testing materials.

Outcomes. Employees receive financial compensation for reaching productivity and quality goals every quarter; they do not receive compensation related to safety behavior. Employees are terminated from working at the facility if they do not improve their performance after receiving corrective feedback twice; their future career stability is not at risk for unsafe body mechanics.

Consequences. Employees receive weekly, group feedback on production and quality goals, but not safety behavior. There is daily monitoring of on-task work-related behavior, and infrequent and inconsistent feedback; daily, individualized feedback is used when productivity and quality is poor. There is no monitoring of safety behavior, employees do not monitor and provide feedback on safety behavior, and employees do not see the effects of their unsafe behavior until days/weeks/years later given the cumulative effects of repetitive tasks. Production and quality demands and deadlines compete with safety behavior, but response effort is not likely to increase from safe body mechanics. Supervisors do not provide safety data to employees.

Figure 2 Summary of the findings from the safety assessment.

hospital laundry or material handling guidelines from the governmental organisations.[28–31]

Development of training materials

The training content was developed based on the list of identified critical behaviours and conditions from the facility's safety assessment results. A research assistant fluent in both English and Spanish translated all training materials. All materials presented to participants were reviewed thoroughly by investigators to ensure that words exceeding grade school reading level were not used. Training content was written at 3rd–4th grade level of the US education system, according to Microsoft Word's Flesch-Kincaid readability score.

Behavioural safety training

Training was conducted separately on three behaviour sets (moving carts, handling linens and generic behaviours). All training sessions were conducted during employees' normal work shifts. Each training session was approximately 30 min and conducted in small groups of 5–8 employees. Implementation of the three training sessions was staggered, with the first training starting 13 days after baseline safety observations. The investigator conducted the training that was delivered in English, and a research assistant who is fluent in both English and Spanish conducted all subsequent training sessions in Spanish, with the supervision of the investigator. For all training sessions, participants were given the opportunity to ask questions. After each behaviour was explained, the trainer allocated time to address employees' questions and comments. The number of questions and concerns raised, and the duration of discussions during each training session were recorded.

First behaviour set: moving carts

Training on moving carts was first conducted in English and involved 13 days of observation, followed by training in Spanish and 41 days of observation. Both training sessions for 'moving

Safety Observation Checklist

Observer : **Date** : **Time** :

 # English-Speaking Ees : **#Spanish-Speaking Ees** : **IOA (%)** :

	1	2	3	4	5	6	7	8	9	10
Environmental	E / S	E / S	E / S	E / S	E / S	E / S	E / S	E / S	E / S	E / S
- Uncongested walkways	S / U	S / U	S / U	S / U	S / U	S / U	S / U	S / U	S / U	S / U
- Clean floor: linens/trash	S / U	S / U	S / U	S / U	S / U	S / U	S / U	S / U	S / U	S / U
- Dry floor	S / U	S / U	S / U	S / U	S / U	S / U	S / U	S / U	S / U	S / U
Total safe:										
Total unsafe:										
Generic										
- Twisting: repetitive	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA
- Straight back: stationary	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA
- Straight back: reaching	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA
- Walking, no rushing	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA
Total safe:										
Total unsafe:										
Pushing Carts										
- Push: both hands	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N
- Push: hands a little above waist level	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA
- Arms, elbows in: arms against rib cage	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA
- Face cart: shift weight from back leg-front	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA
- Legs: shoulder-width apart	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA
- Small steps: turning corners	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA
- Carts: good condition	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA
Total safe:										
Total unsafe:										
Pulling Carts										
- Pull: cart is pulled from truck/against wall	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N
- Pull: both hands	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA
- Pull: hands a little above waist level	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA
- Arms, elbows in: arms against rib cage	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA
- Pull: shift weight from front leg-back	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA
- Legs: shoulder-width apart	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA
- Small steps: turning corners	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA
- Carts: good condition	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA
Total safe:										
Total unsafe:										
Pulling & Sorting Linen										
- PPE: Soiled linen section	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA
- Power grips	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA	S / U / NA
- Shoulder level	S / U	S / U	S / U	S / U	S / U	S / U	S / U	S / U	S / U	S / U
- Change sizes of laundry types	S / U	S / U	S / U	S / U	S / U	S / U	S / U	S / U	S / U	S / U
Total safe:										
Total unsafe:										
Dropping & Catching Linen										
- Linen bag weight: not more than 25lb	S / U	S / U	S / U	S / U	S / U	S / U	S / U	S / U	S / U	S / U
- Stacking: 1 foot	S / U	S / U	S / U	S / U	S / U	S / U	S / U	S / U	S / U	S / U
Total safe:										
Total unsafe:										
Loading or Unloading Linens										
- Handle few items at a time	S / U	S / U	S / U	S / U	S / U	S / U	S / U	S / U	S / U	S / U
- Brace when lifting	S / U	S / U	S / U	S / U	S / U	S / U	S / U	S / U	S / U	S / U
- No twisting back: pivot whole body	S / U	S / U	S / U	S / U	S / U	S / U	S / U	S / U	S / U	S / U
- Cart: placed one side of washer/dryer	S / U	S / U	S / U	S / U	S / U	S / U	S / U	S / U	S / U	S / U
Total safe:										
Total unsafe:										

Comments:

Operational Definitions

Environmental Conditions

- Uncongested walkways — No equipment in walkways (e.g., carts) that is not essential to task being carried out.
- Clean floor: linens / trash (1+ inches) — No linens or trash on floor exceeding 1 inch in diameter.
- Dry floor — Floor around the observed employee is dry (with no liquid larger than 1 inch in diameter)

Generic

- Moving around: awkward position >30°? — Back is straight (30°) and is not engaging in any awkward position that would result in more than 30°. Some motions could include: twisting the hips for more than 30°, or bending the back for more than 30°. This item is scored when employees are 'moving around (i.e. feet not planted on the floor within the whole observation period).
- Stationary: straight back? — Back is straight (at or less than 30°) when working stationary with both feet planted on floor.
- Reaching: straight back? — Bends back less than 30° when reaching for items (including ones that are on the floor), loading, unloading, pushing carts, etc.
- Walking, no rushing — Eye in direction of walking. No running. Maintains a walking pace.

Pushing Carts

- Push: both hands — Use both hands when pushing cart
- Cannot grab cart handles: System barrier? — Item is only scored when employee is NOT grabbing on cart handles. By "cart handles", it means that the cart needs to have proper handles that are purposefully designed for employees to place their hands around the cart handle. "Y" is scored if it was out of the employee's control to perform safely,
- Push: hands a little above waist level — Place hands at or slightly above waist level
- Arms, elbows in: arms against rib cage — Keep upper arms against the rib cage with the elbows in.
- Face cart: shift weight from back leg-front — Face the cart. Point toes in the direction of movement. Bend knees and move the load by shifting weight (i.e. with one leg in front of the other, bend the knees and push by shifting the weight from back leg to the front)
- Legs: shoulder-width apart — Keep feet shoulder-width apart
- Small steps: turning corners — Take small steps when turning corners to avoid twisting the back
- Carts: good condition — Carts should be still in good condition (not wobbly when being pushed, safety pins are working)

Pulling Carts

- Pull: cart is pulled from truck/against wall — Employee is pulling cart from the truck, or when cart was originally placed against the wall and there was no way of "pushing" it out. "N" is scored when pushing is possible under the observed circumstances.
- Cannot grab cart handles: System barrier? — Could the employee wrap his/her hands around the cart handle? Or was the cart filled with linens that they had no way of using the cart handle for pushing/pulling purposes? "Y" is scored it was out of the employee's control to perform safely.
- Pull: both hands — Use both hands when pulling cart
- Pull: hands at or a little above waist level — Place hands at or slightly above waist level
- Arms, elbows in: arms against rib cage — Keep upper arms against the rib cage with the elbows in.
- Face cart: shift weight from front leg-back — Bend knees and move the load by shifting weight (i.e. with one leg in front of the other, bend the knees and push by shifting the weight from front leg to the back)
- Legs: shoulder-width apart — Keep feet shoulder-width apart
- Small steps: turning corners — Take small steps when turning corners to avoid twisting the back
- Is the pull appropriate? — Did employee switch over to "push" when the situation does not require him/her to pull anymore? Item is scored as "N" when employee pulls cart even when pushing is possible
- Carts: good condition — Carts should be in good condition (not wobbly when being pushed, safety pins are working)

Pulling & Sorting Linen

- PPE: Soiled linen section — Employee wears gown and gloves when sorting soiled linen
- Power grips — Grasp the edges of laundry with entire hand instead of just fingers. To do this, grasp larger portions of laundry pieces and bundle them up in hand. If employee is doing a half-power/pinch grip, score as "U". This item is scored only when employee is handling larger sizes of linens, (i.e. pulling 1 piece of linen out from a pile), not when handling smaller sizes of linens, such as handkerchiefs or simply just grabbing folded linens.
- Shoulder level — Arms are not raised above shoulder level when working continuously (i.e. elbows lifted above shoulder-level).
- Have to lift arms higher than shoulder level? — If the employee is lifting arms higher than shoulder level, was it because the linen was too long for him/her? (i.e. if the employee did not lift arms higher than arm level while holding the linen, the linen will be touching the floor)
- Stacking: 1 foot — Linens are not stacked higher than 1 foot on ironing/folding area
- Back: Reaching into bin, back > 30° — Item is scored as "Y" if employee had to bend their back for more than 30° when grabbing linens from a bin, or simply just reaching for a bin. "Y" is scored if employee was observed bending back for more than 30° while trying to reach for linens in the bin. This item is only scored when there is a bin that the employee is working with (i.e. bin beside the ironing machine or the bin in front of the conveyor belt at the soiled linen section)
- Change sizes of laundry types — After folding or ironing 3 pieces of the same type/size of linens, rotate the type/size of linen. This item is only scored when employee is directly handling linens. An example of where this item would not apply would be the employees who are tasked to break apart the plastic bags and place the linens on the conveyor belt at the soiled linen section.
- Have option to change sizes of laundry? — "Y" is scored if there the employee had the option to change sizes of laundry (i.e. working with more than 1 type/size of linen every 3 times the employee handles the same type of linen)

Figure 3 The checklist used to score employees' safety during the observation process.

carts' were conducted via spoken and written PowerPoint presentation, and did not include any demonstrations, pictures or videos of safe and unsafe behaviour.

Second behaviour set: handling linens

Training on handling linens was delivered in Spanish after 37 days of baseline observation and involved a presentation with pictures (examples of safe and unsafe body mechanics), explanations and demonstrations of safe and unsafe behaviours.

Third behaviour set: generic behaviours

Training on generic behaviours was delivered in Spanish after 52 days of baseline observation and included a presentation with videos depicting examples of safe and unsafe behaviours, along with explanations and demonstrations of safe and unsafe behaviours.

Forth behaviour set: environmental conditions

The fourth behaviour set served as a control condition since participants received no information, training or testing over these safety behaviours. Data pertaining to the environmental conditions around the employees' workstation were observed and collected throughout the course of the study.

Testing

Prior to the start of each training session, a pre-test was administered to all employees to examine any pre-existing safety knowledge that was obtained from safety training obtained from other jobs. At the end of each training session, a post-test was administered to examine knowledge acquisition of safety information after safety training. Knowledge tests were delivered in written Spanish. Pre-test and post-test questions were the same; however, the phrasing and order of the questions in each post-test were changed to prevent repeated testing bias (see figure 4 for all pre-test and post-test questions). At the conclusion of the study, all participants completed an evaluation survey to determine their perceived benefits and experiences with the behaviour-based safety (BBS) training in English and Spanish.

Observation process

Throughout the course of the study, each observer conducted observations approximately three times per week, and each observation session lasted approximately 1.5 h. Since most participants typically work in the same workstation or area, observers were required to use a specific route when observing to ensure that all participants were observed and their safe and unsafe behaviours were recorded. An observation session ended when approximately two data points had been recorded for each participant who was present during that particular observation session. Participants were informed during the consent phase that observations of their safety behaviour would periodically occur during the study, but they were not informed of when the observations would take place. All observations were overt, meaning the observers were in the view of the participants while observing and recording participant behaviour on the paper checklist.

Interobserver agreement (IOA) was conducted on 23% of the total number of observations each week (ie, three IOA sessions out of 13 observation sessions a week). The formula used to calculated percentage of agreement on "Safe" behaviours was [Number of agreements with "Safe" responses÷Number of "Safe" agreements+Number of "Safe" disagreements×100]; the percentage of agreements on "Unsafe" behaviour was calculated using [Number of agreements with "Unsafe" responses÷Number of "Unsafe" agreements+Number of "Unsafe" disagreements×100]. The overall average safe agreement was 90% (ranged between 82% and 97%), and the overall average unsafe agreement was 85% (ranged between 75% and 99%) for all behaviours observed during the study.

Feedback process

Weekly percentage safe for each behaviour set was graphed and posted on both sides of the only door to the production floor; therefore, employees saw the graph as they entered the production floor and again when they exited the production floor. To the right of the graph, safety tips were written in bold font for that behaviour set, under the words "REMEMBER!". Graphs were updated every Friday and consisted of data from Friday (the week before) to Thursday. There were a total of 10 feedback postings. The safety percentage for previous weeks remained part of the graph each time it was updated to allow participants to see the change of group behaviour over the course of weeks.

Feedback was only posted on behaviour that was trained by the researchers; the first feedback posting for a behaviour set occurred 1 week after training that specific behaviour set. The graphs and safety tips were written in English after the English training and in Spanish after the subsequent trainings delivered in Spanish. Participants were informed that feedback was posted and where it was located, but researchers and production floor supervisors did not discuss the feedback with participants during the study.

Cost–benefit analysis

A cost–benefit analysis was conducted with the help of OSHA's "$afety Pays Program",[32] which provided information about the average cost of an injury or illness. Injuries were categorised and matched according to the categories that were provided by OSHA, and direct costs were calculated by referring to the estimated cost. Indirect costs were calculated by using an average ratio of indirect to direct costs.[33] The total cost for one injury or illness occurrence was calculated by adding the direct cost and the indirect cost; this was repeated for all the remaining documented injuries and illnesses.

RESULTS

Statistical analyses were conducted (using SPSS V.21) on behavioural safety from observations across baseline, training in English and training in Spanish, and on knowledge outcomes from pre-tests and post-tests on three behaviour sets. For brevity and consistency with the behavioural analysis, only the first 13 days of baseline observations were used for analysis across all behaviour sets.

Knowledge effects

Independent t tests conducted on knowledge outcomes from pre-tests and post-tests on three behaviour sets demonstrated significant differences in test scores on carts and generic behaviours when participants were trained in Spanish. Cohen's $d=1.0559$ for carts after Spanish training, and $d=0.7765$ for generic behaviours after Spanish training, which would both be considered large according to Cohen's magnitude of effects.[34] However, significant differences were not found with linens following Spanish training, nor carts after English training (table 2).

Behaviour effects

A one-way analysis of variance (ANOVA) showed that the percentage safe for carts was significantly affected by training, with

Pre-Test Questions	Post-Test Questions
Moving Carts (English Training)	
1. When moving linens with a cart, should you use one hand or both hands? 2. What is the safest way to move linens with a cart: pushing while facing the cart, pulling while facing the cart, or both? 3. When moving linens with a cart, hands should be placed on the cart slightly above waist level. True or false? 4. When moving linens with a cart, it is safer to keep your arms against the rib cage with the elbows in. True or false? 5. How far apart should your feet be when moving linens with a cart? a. Shoulder-width b. Wider than shoulder-width c. Your feet should not be apart 6. When moving linens with a cart, it is safer to take small steps when turning corners. True or false? 7. Carts should not be used when they are in bad condition - list 1 example of when carts are in bad condition	1. How many hands should you use when moving linens with a cart? a. Use one hand b. Use both hands c. Use the hand that you use for writing or eating 2. What is the safest way to move linens with a cart? a. Pull with your back facing the cart b. Push while facing the cart c. Kick the cart 3. How high should you place your hands when moving linens with a cart? 4. Where should you put your arms and elbows when moving linens with a cart? 5. When moving linens with a cart, it is safer to keep your feet wider than shoulder-width. True or false? 6. When moving linens with a cart, what should you do with your feet when you are turning corners? 7. A cart should still be used even when the safety pins do not work. True or false?
Moving Carts (Spanish Training)	
1. When moving linens with a cart, it is safe to hold the cart with only one hand. True or false? 2. When moving linens with a cart, it is always safest to face the cart when pushing. True or false? 3. How high should your hands be when moving linens with a cart? a. At chest level b. Slightly below waist level c. Slightly above waist level 4. Which is the safest way to put your arms and elbows when moving linens with a cart? a. Arms against the rib cage with the elbows back b. Arms away from the rib cage with the elbows out c. Arms and elbows lifted high 5. How far apart should your feet be when moving linens with a cart? 6. When moving linens with a cart, what should you do with your feet when you are turning corners? 7. A cart should be used when _____. a. the cart is wobbly when pushed b. the safety pins do not lock properly c. the cart can be easily pushed d. the wheels on the cart do not turn easily	1. When moving linens with a cart, should you use one hand or both hands? 2. How far apart should your feet be when moving linens with a cart? a. Shoulder-width b. Wider than shoulder-width c. Your feet should not be apart 3. When moving linens with a cart, it is safer to keep your arms against the rib cage with the elbows in. True or false? 4. A cart should still be used even when the safety pins do not work. True or false? 5. When you are turning corners while moving linens with a cart, which is safer? a. Taking huge steps b. Taking moderately huge steps c. Taking small steps 6. How high should you place your hands when moving linens with a cart? 7. What is the safest way to move linens with a cart? a. Pull with your back facing the cart b. Push while facing the cart c. Kick the cart
Handling Linens (Spanish Training)	
1. What protective equipment should you use when sorting dirty linens? 2. Power grips should be used when pulling and sorting linens. A power grip is when you grab the edges of the laundry with just your fingers instead of your hand. True or false? 3. Fill in the blank: When pulling or sorting linens, arms should not be raised above _____. a. Shoulder-level b. Chest-level c. Eye-level 4. Fill in the blank: Linens cannot be stacked higher than _____. a. 1 foot b. 1.5 foot c. 2 foot 5. You should rotate the types and sizes of linen when folding or ironing linens. True or false?	1. When sorting soiled linens, as long as you are wearing a gown you do not have to wear gloves. True or false? 2. Power grips should be used when pulling and sorting linens. What is the correct way to do a power grip? a. Grab edges of the linen with fingers b. Grab any part of the linen with fingers c. Grab edges of the linen with the whole hand 3. When pulling or sorting linen, what is the safe maximum height to lift your arms without hurting yourself? 4. It is safe for linens to be stacked higher than 1 foot. True or false? 5. What should be rotated when folding or ironing linens? a. Type of linen b. Size of linen c. Type and size of linen
Generic Behaviors (Spanish Training)	
1. Should you twist your back for more than 30° while working? a. No b. Yes, at all times c. Yes, whenever necessary 2. The maximum degree angle that you can twist your shoulders and hips is at 30 degrees. True or false? 3. How should you position your back when you are working? a. Slightly bent b. Bent c. Straight 4. When working, both feet should be placed flat on the floor. True or false? 5. When reaching for items, you should only bend your back less than _____ degrees. a. 30 degrees b. 40 degrees c. 50 degrees 6. When walking, you should _____. a. Look around and walk slow b. Look straight and walk fast c. Look straight and walk normally	1. When working, back can be twisted for more than 30 degrees. True or false? 2. What is the maximum degree angle that you can twist your shoulders and hips when doing a task? a. 30 degrees b. 40 degrees c. 50 degrees 3. When working, back should be straight. True or false? 4. How should you position your feet when you are working? a. Both feet should be placed flat on the floor b. One feet placed flat on the floor, and one feet resting on top of the other feet. c. Whichever position that is comfortable 5. What is the maximum degree angle that you can bend your back when reaching for items? 6. You should look forward when you're walking straight. True or false?

Figure 4 Pre-test and post-test questions administered to employees to examine knowledge acquisition.

Table 2 Knowledge results by phase

	English training					Spanish training				
Variables	Pre-test	Post-test	t	df	d	Pre-test	Post-test	t	df	d
Moving carts	77.6 (16.0)	72.7 (14.8)	1.068	43	−0.3189	72.7 (20.62)	90.2 (11.28)	−3.581**	44	1.0559
Handling linens						60.0 (21.74)	68.7 (24.74)	−1.266	44	0.3732
Generic						70.8 (21.54)	86.7 (19.19)	−2.454*	38	0.7765

*p<0.05, **=p<0.001. SDs appear next to the means in parentheses. *d*=Cohen's d; effect size computed with independent t-tests.

an effect size (η_p^2=0.389) considered large by Cohen[34] (magnitude of effects for η_p^2 is 0.02 for small, 0.13 for medium and 0.26 for large). Post hoc tests using Bonferroni correction showed cart safety was higher than baseline following English training and Spanish training. However, significant differences were not found between English and Spanish trainings. For linens and generic behaviours, a one-way ANOVA showed the difference in percentage safe between baseline and Spanish training was significant, with effect sizes for both considered large by Cohen (η_p^2=0.675 for handling linens; η_p^2=0.389 for generic behaviours). For the control condition, a one-way ANOVA showed percentage safe for environmental conditions was significantly different between phases, wherein environmental safety was highest during baseline and declined during the BBS process that targeted the other behaviours. Post hoc tests using Bonferroni correction showed significant differences between baseline and English training on carts, and baseline and Spanish training on linens (table 3).

These findings suggest a possible facilitating variable in the BBS process is aiding participants' transfer of training from learning to behaviour. More specifically, Arthur and colleagues[8] found the mean effect size (d) from learning to behaviour was −0.77. However, the current study found an increase in effect sizes (d) from learning to behaviour across the three targeted behaviour sets; the increases were 1.143 for carts, 2.373 for linens and 0.7665 for generic. To further explore the possible mediating variables that lead to performance improvements from learning to behaviour, analyses were conducted on the effects of training versus the effects of feedback on behaviour.

Feedback effects

To determine whether changes in safety behaviour were related to training or feedback or a combination of training and feedback, combined safety behaviour (carts, linens and generic) was compared with Spanish training and Spanish feedback phases, in addition to safety behaviour under no training and no feedback. Safety behaviour (n=15 observation days) for *No Training, No Feedback* was calculated from the days immediately prior to training, and when Spanish feedback was not in place for that specific behaviour (ie, last 5 days in baseline for carts, 5 days prior to Spanish linens training for linens, 5 days prior to Spanish generic training for generic). Safety behaviour (n=15 observation days) for *Training, No Feedback* was calculated from the days immediately following training, but prior to Spanish feedback (ie, 5 days after Spanish training for carts, 5 days after Spanish training for linens, 5 days after Spanish training for generic). Safety behaviour (n=14 observation days) for *Training, Feedback* was calculated from the week after training and immediately after delivering Spanish feedback for that specific behaviour (ie, from the 4 days following Spanish feedback for carts, 5 days following Spanish feedback for linens, 5 days following Spanish feedback for generic).

A one-way ANOVA showed that safety behaviour was significantly affected by a combination of training and feedback in Spanish, F(2, 41)=6.558, p<0.003. Bonferroni correction found that participants' safety did not significantly improve from baseline when only training was delivered; additionally, safety did not significantly improve from training alone when training and feedback were delivered. However, the combination of training and feedback resulted in significantly safer behaviour compared with no training and no feedback. The effect size for the analysis comparing overall safety behaviour under *Training and Feedback* to overall safety behaviour under *No Training, No Feedback* was d=1.546, which exceeds Cohen's guidelines for a large effect (d=0.80). Overall safety behaviour under *Training, No Feedback* to *No Training, No Feedback* was d=0.7737, whereas safety behaviour under *Training and Feedback to Training, No Feedback* was d=0.4706 (table 4).

Cost–benefit analysis

For the purposes of this cost–benefit analysis, the total cost of injuries was only calculated for the period of July 2012–October 2012 (4 months) to compare against the cost of injuries that occurred within the duration of training and observations, February 2013–May 2013 (4 months). The cost of injuries before the intervention was $263 068.60 and the cost of injuries

Table 3 Behavioural safety results by phase

	Baseline		English training		Spanish training				
Variables	n	Mean	n	Mean	n	Mean	F	η_p^2	d
Moving carts	13	64.8^a (6.97)	14	75.1^b (9.68)	10	79.8^{bc} (6.70)	10.840*	0.389	2.199
Handling linens	13	53.5^a (8.64)			15	73.8^b (5.86)	54.037*	0.675	2.745
Generic	13	61.3^a (12.7)			16	77.9^b (8.33)	17.870*	0.398	1.543
Environmental	13	81.5^a (6.53)	14	71.4^b (6.12)	15	73.8^{bc} (4.99)	5.360*	−0.254	−1.318

SDs appear next to the means in parentheses. Means with differing subscripts within rows are significantly different at p<0.05 based on Bonferroni post hoc multiple comparisons; means with the same subscripts within rows are not significantly different.
*p<0.001.
η_p^2, the effect size comparing baseline versus Spanish training computed with analysis of variance; n, number of observation days used in the analysis.

Table 4 Training effects versus feedback effects

	No Training, No Feedback		*Training, No Feedback*		*Training, Feedback*		
	n	Mean	n	Mean	n	Mean	F
Overall safety behaviour	15	69.9[a] (6.25)	15	75.5[ab] (8.25)	14	78.8[b] (5.24)	6.558*
				d		d	
No Training, No Feedback				0.7737		1.546	
Training, No Feedback						0.4706	

SDs appear next to the means in parentheses. Means with differing subscripts within the row are significantly different at p<0.05 based on Bonferroni post hoc multiple comparisons; means with the same subscripts within the row are not significantly different.
*p<0.005.

during the course of the intervention was $190 833.60—approximately 27.5% reduction in injury costs. A comparison of the injury occurrences before and during the intervention is illustrated in table 5.

Estimated costs for developing training materials, training assistants to accurately observe safety and implementing the translated training were also calculated. The total estimated pay for four safety observers was $6000, which covered training time for the assistants (20 h) and performing safety observations by the assistants throughout the course of 5 months (200 h). Estimated time for developing training materials and implementing the BBS process was approximately 300 h. The estimated pay for a master's-level BBS consultant's effort (in the Midwest region of the USA) in developing the above-listed materials was $19 500. Translations of training materials took 55 h, and the estimated pay for the translator's efforts was $1650. The four training sessions cost $780 for the presenter's time (12 h). Refreshments were also provided for participants during all training sessions, and the total amount spent was approximately $120. Therefore, the financial benefit of the BBS process was an approximately 15% reduction in injury costs after factoring in the cost of the process. It should be noted that each time this training is delivered, savings will be greater since development of translation costs is not required each time. A limitation of this analysis concerns the possibility that injury rates are related to varying production demands at different times of the year in the healthcare industry.

Using another method of training evaluation that is reported each year by the American Society of Training and Development, the cost of training and development per employee was examined and compared with the average spending for small companies (<500 employees). According to the *2013 State of the Industry Report: ASTD Research*, small companies spend on average $1800 per employee to develop and deliver training each year; noteworthy, it was reported that health-related jobs have higher costs per employee due to the specific tasks, which require clear and precise definitions of knowledge and behaviours for those tasks. In comparison, this study spent $1345 per employee to develop and deliver training, and implement weekly observations and feedback—that is >$10 000 in total savings compared with training developed and delivered in the small organisations surveyed in the *ASTD* research.

Reaction effects

A survey in Spanish was delivered to employees to examine the social validity of the behavioural safety process. Table 6 presents employees' perceived benefits of training in English versus Spanish, acquired safety knowledge, improved safety behaviour and changes in confidence levels towards their work and self. Most employees favoured training in Spanish and overall, perceived acquired knowledge, safety and confidence was greater after the Spanish. In regards to language barriers, results showed that 73% of employees agreed that working in an English-speaking organisation is difficult. Follow-up comments on this had the same theme: English is not their primary language and understanding their English-speaking supervisors is hard. Furthermore, 100% of employees indicated that they would like to receive more Spanish training (45% want this training once/month, 30% once/year and 20% once/3 months). Lastly, employees indicated they would like to have translations of all training manuals, emergency exits, safety equipment, chemical information and safety tips.

Table 5 Cost–benefit analysis

	Before BBS process (July 2012–October 2012)			During BBS process (February 2013–May 2013)			Training*
	# Injuries	Direct cost†	Indirect cost‡	# Injuries	Direct cost	Indirect cost	Cost
Moving carts	2	64 614	71 074.90	1	26 235	28 858.50	
Handling linens	2	60 657	66 722.70	2	64 638	71 101.80	
Generic behaviours	0	0.00	0.00	0	0.00	0.00	
Total	4	125 271	137 797.60	3	90 873	99 960.60	30 930
Grand total			263 068.60			190 833.60	
Savings after BBS							+41 305.00

*Cost to develop training materials, train safety observers, and implement training and observation.
†Calculated by referring to the estimated cost provided by OSHA.[32]
‡Calculated by using an average ratio of indirect to direct costs.[33]
OSHA, Occupational Safety & Health Administration.

Table 6 Reported effects of training

Employee self-reported	English training (%) (n=21)	Spanish training (%) (n=22)
Extent learned		
≥10 safety tips	10	55
7–9 safety tips	24	27
4–6 safety tips	14	14
0–3 safety tips	52	5
Behavioural levels		
Always safe (100% of the time)	14	68
Mostly safe (60% of the time)	19	14
Somewhat safe (40% of the time)	10	9
A little safe (20% of the time)	19	9
Never safe (0% of the time)	38	0
Work confidence		
More confident	29	86
Same as before	24	14
Less confident	5	0
Not confident	43	0
Self confidence		
More confident	33	86
Same as before	24	9
Less confident	0	5
Not confident	43	0

Preferred method of training	Rank	Percentage
Spanish demonstrations/videos	1	59
Spanish demonstrations/pictures	2	86
Only spoken and written Spanish	3	62
Only spoken and written English	4	91

Employees' participation during training was also observed to examine differing levels of interaction between English and Spanish trainings. During English training, all employees participated passively, nobody asked questions or voiced any concerns, even when prompted; mean time spent answering employee questions or engaging in discussions during the English training was zero minutes. During Spanish training, almost all of the employees spoke up and actively participated in questions, asked for clarification and/or discussed possible workplace changes to improve safety. Mean time spent answering employee questions or engaging in discussions during the Spanish training was 15 min. It was also observed during the Spanish trainings that employees would perform demonstrations among themselves to see if they performed behaviours the same as the trainer.

DISCUSSION

Our analyses found that a foreign-born Hispanic workforce with limited English literacy and formal education: (a) learned and applied work-related safety tips when training was delivered in Spanish; (b) preferred face-to-face, small group training (95%), (c) increased safety communication and discussion; and (d) improved confidence towards work and self. This study also found that learning is related to behaviour change, but it is not the only factor.[8] Our findings appear to suggest that transfer of training is facilitated by feedback, even in the absence of praise, rewards and goals. The implications of these findings are that researchers examining Hispanic workers' safety should not only be concerned about how training is developed and delivered, but how feedback is delivered to workers. These results also have implications for small corporations who are hesitant to invest in new safety training because of time and costs. Our approach to implement the most common type of training delivery method used by corporations (*2013 State of the Industry Report: ASTD Research*), with less costs, effort and technology should be encouraging for management, especially since effectiveness was demonstrated on all four Kirkpatrick evaluation levels.[3,5]

Future research should focus efforts on developing an assessment to better understand the cultural factors that may affect the delivery of training and feedback, and subsequent changes in safety behaviour. Is it possible Hofestede's data on cultural differences accurately explains how training and testing should be developed and delivered differently to Hispanics; and that such changes to training and testing do lead to differences in reactions, learning, behaving and results? More specifically, does receiving feedback as a group create a greater sense of belonging to a group or community, and does that sense of belonging create more engagement and commitment to working safely? One could systematically examine face-to-face training in small groups versus individual CBT to determine whether interactions with trainers and peers improve knowledge acquisition, transfer of training, sense of belonging, psychological safety, and diversity and safety climate. One limitation of the present study was that the research design was not fully counterbalanced, in that none of the employees received Spanish training prior to English training. This approach was chosen because the researchers were primarily interested in the effects of adding Spanish training to the common workplace scenarios of English training only or no training at all for Hispanic workers. However, future researchers should adopt research designs that include counterbalancing in order to permit stronger causal inferences. Lastly, researchers should involve Hispanic workers in the development phase of training and feedback materials so they are more culturally appropriate, and examine the effects of

What is already known on the subject

- Hispanic workers are not receiving adequate safety training that accounts cultural, language and/or learning barriers to prevent occupational injuries.
- There is a lack of research reporting the evaluation of training with behavioural and results measures, especially with Hispanics' workplace safety.
- CBT is an effective method for improving Hispanics' safety knowledge and behaviour, but it is not always a practical, adequate or cost-effective solution for small businesses.

What this study adds

- A systematic assessment of an organisation's training needs to guide development, implementation and evaluation of a behavioural safety process with Hispanic workers.
- Behavioural, graphic feedback facilitated the transfer of training with safety behaviour.
- Hispanic workers preferred small group training with videos instead of group training with pictures.

such involvement given that this has been demonstrated to be an effective component with American workers.[36]

CONCLUSION

The improvements to the target company's safety training, monitoring and feedback process resulted in increases with their Hispanic workers' safety behaviour, knowledge, work and self-confidence. The language translation of training and testing materials was related to improved knowledge acquisition, perceptions of safety and preference for group training with videos; yet it appears that feedback was the crucial factor for changes in safety behaviour. A cost-effective, low-technology, behavioural safety process aimed at foreign-born Hispanic workers can contribute to improvements in safety behaviour and medical costs associated with injuries.

Acknowledgements The authors wish to thank anonymous reviewers for their valuable suggestions that improved this manuscript, especially with respect to the data analysis.

Contributors ARL: conceived and designed the study, obtained funding, located and secured participating organisation, conducted interview/tour assessment, developed safety process, conducted statistics, manuscript writing and revision for publication. SCL: wrote ethics protocol, conducted interview/tour assessment and injury assessment, developed checklist and training materials, data collection and management, research assistant and participant training, cost–benefit analysis, approval of version to be published. DJ: designed the study, located research assistants, managed weekly data updates, organisation, and interpretation, cost–benefit analysis, edited ethics protocol, approval of version to be published.

Funding This work was supported by PSC-CUNY Award (grant number 65744-00 43), jointly funded by The Professional Staff Congress and The City University of New York.

Competing interests None declared

Ethics approval City University of New York and Western Michigan University's ethics boards.

Provenance and peer review Not commissioned; externally peer reviewed.

Data sharing statement The data used for analysis in this study are available from ARL and SCL. Almost all the analyses performed are presented in this manuscript.

REFERENCES

1 Smith SM, Perry T, Moyer D. Creating a safer workforce: training needs for Hispanics and foreign-born workers. *Prof Saf* 2006:20–5.
2 Harrington D, Materna B, Vannoy J, *et al*. Conducting effective tailgate trainings. *Health Promot Pract* 2009;10:359–69.
3 Sokas R. CDC Efforts to Address the Health and Safety Needs of Immigrant Workers. *Testimony Before the Senate Subcommittee on Employment, Labor and Pensions, Committee on Health, Education, Labor, and Pensions* 27 February 2002. http://www.hhs.gov/asl/testify/t20020227.html
4 Acosta-Leon AL, Grote BP, Salem S, *et al*. Risk factors associated with adverse health and safety outcomes in the US Hispanic workforce. *Theor Iss Ergo Sci* 2006;7:299–310.
5 Hofstede G. National cultures in four dimensions: a research-based theory of cultural differences among nations. *Int Stud Mgmt Org* 1983;13:46–74.
6 Hofstede G. *Research and VSM: The Dimension Data Matrix*. 2015. http://geerthofstede.eu/research--vsm
7 Irvine JJ, York DE. Learning styles and culturally diverse students: a literature review. In: Banks JA, Banks CAM, eds. *Handbook of research on multicultural education*. New York: Macmillan, 1995:484–97.
8 Arthur W, Bennett W, Edens P, *et al*. Effectiveness of training in organizations: a meta-analysis of design and evaluation features. *J of Appl Psy* 2003;88:234–45.
9 Geller SE. Behavior-based safety in industry: realizing the large-scale potential of psychology to promote human welfare. *App Prev Psych* 2001;10:87–105.
10 DePasquale JE, Geller ES. Critical success factors for behavior-based safety: a study of twenty industry-wide applications. *J Safety Res* 1999;30:237–49.
11 Austin J. Performance analysis and performance diagnostics. In: Austin J, Carr JE, eds. *Handbook of applied behavior analysis*. Reno, NV: Context Press, 2000:321–50.
12 Burke MJ, Sarpy JA, Smith-Crowe K, *et al*. Relative effectiveness of worker safety and health training methods. *Am J Public Health* 2006;96:315–24.
13 Saks AM, Burke LA. An investigation into the relationship between training evaluation and the transfer of training. *Int J Train Dev* 2012;16:118–27.
14 Levesque DL, Arif AA, Shen J. Effectiveness of pesticide safety training and knowledge about pesticide exposure among Hispanic farmworkers. *J Occup Environ Med* 2012;54:1550–6.
15 Williams Q, Ochsner M, Marshall E, *et al*. The impact of a peer-led participatory health and safety training program for Latino day laborers in construction. *J Safety Res* 2010;41:253–61.
16 Chapman LJ, Newenhouse AC, Pereira KM, *et al*. Evaluation of a four year intervention to reduce musculoskeletal hazards among berry growers. *J Safety Res* 2008;39:215–24.
17 Donaldson SI, Grant-Vallone EJ. Understanding self-report bias in organizational behavior research. *J Bus Psych* 2002;17:245–60.
18 Cooper MD. Behavioral safety interventions: a review of process design factors. *Prof Saf* 2009;54:36–45.
19 Brown MG, Malott RW, Dillon MJ, *et al*. Improving customer service in a large department store through the use of training and feedback. *J Org Beh Manag* 1980;2:251–65.
20 Myers WV, McSween TE, Medina RE, *et al*. The Implementation and Maintenance of a Behavioral Safety Process in a Petroleum Refinery. *J Org Beh Manag* 2010;30:285–307.
21 Anger WK, Tamulinas A, Uribe A, *et al*. Computer-based training for immigrant Latinos with limited formal education. *Hispanic J Behav Sci* 2004;26:373–89.
22 Anger WK, Stupfel J, Ammerman T, *et al*. The suitability of computer-based training for workers with limited formal education: A case study from the US agricultural sector. *Int J Train Dev* 2006;10:269–84.
23 Austin J, Alvero AM, Fuchs MM, *et al*. Pre-training to improve workshop performance in supervisor skills: An exploratory study of Latino agricultural workers. *J Agric Saf Health* 2009;15:273–81.
24 Amigo S, Smith A, Ludwig T. Using task clarification, goal setting, and feedback to decrease table busing times in a franchise pizza restaurant. *J Org Beh Manag* 2008;28:176–87.
25 Austin J, Weatherly NL, Gravina NE. Using task clarification, graphic feedback, and verbal feedback to increase closing-task completion in a privately owned restaurant. *J Appl Beh Anal* 2005;38:117–20.
26 Johnson DA, Rubin S. effectiveness of interactive computer-based instruction: a review of studies published between 1995 and 2007. *J Org Beh Manag* 2011;31:55–94.
27 McSween T. *The value-based safety process: improving your safety culture with behavior-based safety*. 2nd edn. New York: Wiley, 2003.
28 Occupational Safety & Health Administration (OSHA). *Healthcare Wide Hazards: Ergonomics*. n.d.-a. https://www.osha.gov/SLTC/etools/hospital/hazards/ergo/ergo.html
29 Occupational Health and Safety Agency for Healthcare in BC (OSHAH). An Ergonomics Guide for Hospital Laundries. 2003. http://www.mtpinnacle.com/pdfs/LaundryHandbook.pdf
30 Occupational Health and Safety Agency for Healthcare in BC (OSHAH). *Using Carts in Healthcare: A Resource Guide for Reducing Musculoskeletal Injury*. 2005. http://www.asstsas.qc.ca/documents/Dossiers%20thematiques/Equipements/Chariots/OHSAH_Rolling%20Carts%20Handbook.pdf
31 WorkSafeBC. MSI Prevention Bulletin 8: Laundry in Health Care Facilities; n.d. http://www.worksafebc.com/publications/health_and_safety/bulletins/msi/assets/pdf/msi8_laundry.pdf
32 Occupational Safety & Health Administration (OSHA). *OSHA's $afety Pays Program: Estimated Costs of Occupational Injuries and Illnesses and Estimated Impact on a Company's Profitability Worksheet*; n.d.-b. https://www.osha.gov/dcsp/smallbusiness/safetypays/estimator_text.html
33 Business Roundtable. Improving construction safety performance. Report A-3. 1982. http://constructionsafetyconsultant.com/articles/report_a_3.pdf
34 Cohen J. *Statistical power analysis for the behavioral sciences*. 2nd edn. Hillsdale, NJ: Erlbaum, 1988.
35 Kirkpatrick DL, Kirkpatrick W. *Evaluating training programs: the four levels*. 3rd edn. San Francisco, CA: Berrett-Koehler, 2006.
36 Sigurdsson SO, Austin J. Institutionalization and response maintenance in organizational behavior management. *J Org Beh Manag* 26:41–77.

Feedback facilitates transfer of training with US Hispanic workers in a healthcare laundry linen facility

Angela R Lebbon, Sin Chien Lee and Douglas A Johnson

Inj Prev 2015 21: 404-414 originally published online July 14, 2015
doi: 10.1136/injuryprev-2015-041620

Notes