Occup Health Sci (2018) 2:203–214
https://doi.org/10.1007/s41542-018-0016-6

BRIEF RESEARCH REPORT

The Impact of Story-Based Video Back Injury Prevention Training on Employee Motivation, Engagement, Knowledge, and Behavior

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Received: 24 August 2017 / Accepted: 14 May 2018 / Published online: 29 May 2018

Introduction

Back pain is a leading cause of disability and is the most common reason for medical visits worldwide (Ehrlich 2003). Back pain accounts for over 20 million disability-adjusted life years (DALYs) globally, of which 35% is due to occupational risk factors (Fan and Straube 2016; Guo et al. 1995). The total cost of low back pain in the United States is greater than $100 billion per year, with two-thirds of the cost due to reduced productivity and lost wages (Katz 2006). In 2014, the incidence rate for nonfatal occupational back injuries was 18.5% with a median value of 8 missed workdays for each injury (Bureau of Labor Statistics 2015). On-the-job back injuries are largely preventable using ergonomic programs and strategies, yet incidence and prevalence of back injuries among workers remain significant (Fan and Straube 2016). Healthcare workers, specifically, often experience musculoskeletal disorders (MSDs) at a rate exceeding that of workers in construction, mining, and manufacturing (Bureau of Labor Statistics 2007). These injuries are due in large part to repeated patient handling activities, often involving heavy manual lifting associated with transferring and repositioning patients and working in extremely awkward postures (State of Washington 2006; Collins et al. 2006).

One strategy for educating workers about back injury prevention is through online training. The proliferation of online training over the last several years creates opportunities for organizations to deliver up-to-date occupational safety content at convenient times and lower costs than traditional classroom-based courses (Trout 2016; Cheng et al. 2014). Online training using story-based video training is one component of online training aimed at increasing learner engagement and knowledge. Research has shown that safety and health training in occupational health

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settings is more effective in improving behavior in workers when the messages contain story (Cullen 2008; Ricketts et al. 2010). Online training is considered story-based when it includes an account of events that take place over time. In contrast, non-story-based training consists of statistics and generalized statements based on multiple events across populations (Ricketts 2015). Story-based training may or may not involve telling a true story, though research shows stories are most effective when they are believable (Ricketts 2015; Cullen 2008; Ricketts et al. 2010). Stories can be communicated in various ways such as narration by one storyteller, narration by multiple storytellers who provide different perspectives, actors acting out the story, and a combination of narration and acting. For safety-based training, storytelling often details how a worker should perform a certain task in a safe way or how one should respond to an unsafe situation or emergency. An effective tool is showing the negative consequences of unsafe behavior (Cullen 2008; Ricketts et al. 2010; Strecher et al. 2008).

Communicating story-based training through video is advantageous because video provides a visual demonstration, can alleviate confusion, and facilitates highlighting main points of the training (Ricketts 2015; Cullen 2008). Theories about story-based training state that triggering one's memory of related personal experiences, introducing previously unimaginable scenarios, and evoking emotions that typically coincide with first-hand experience are ways that story effectively impacts behavior (Green and Brock 2000; Sherer and Rogers 1984; Schank and Abelson 1977). For greater likelihood of successful behavior change, stories should engender two key beliefs in learners—the outcome is important, and the learner has control over the outcome (Glanz et al. 2008).

An example of effective use of story-based training is a series of eight safety videos distributed by the National Institute of Occupational Safety and Health (NIOSH). These videos showed younger, inexperienced minors performing unsafe acts in mines while older, experienced mentors related stories about how such acts have produced negative consequences. NIOSH distributed over 7000 copies of these videos, and researchers evaluated the videos very positively. Some positive attributes of the story-based videos included the use of real-life minors and mines, entertaining content including some humor, and stories and situations that were relatable (Cullen 2008). In another example, Strecher et al. (2008) used hypothetical success stories in an online smoking cessation intervention targeting 1866 smokers from two large health plans. In this study, participants received a story that was tailored to their profile (e.g., a married woman would receive a hypothetical smoking quit success story about a married woman). Use of online stories in this study appeared to increase engagement for participants.

While studies have reported positive effects of video and story, separately, on learning outcomes in occupational health settings, there is a lack of research comparing story-based video training to the more common training that does not include story-based video training on learner motivation, engagement, knowledge, and behavior (Suhasini and Suganthalakshmi 2015; Zhang et al. 2006; Ricketts 2015). Story-based video development often involves investment in professional writers,

actors, and expensive production equipment, increasing the cost of the training to employers. Research about the impact of different training formats of back injury prevention content will help occupational health and safety officers make decisions about optimal allocation of training resources, and whether to spend significantly more funds on story-based video training. This study is unique in that it compares the impact of two online training courses with identical content, differing only by whether or not it offers story-based video media delivery, on motivation, engagement, knowledge, and behavior.

Methods

Participants

The online health education company recruited participants from two long-term care healthcare companies, one with operations across the Midwest and the other in Texas, and whose job requirements included activities that could potentially cause back injury such as lifting patients or sitting at a computer for long periods of time. Employers notified the employees about the voluntary back injury prevention study via email and their supervisors. Neither company had offered a back injury prevention course in the past, so any interested participants were allowed into the study. The participants did not have to pay for the program as the course was offered as an option within their company's staff development and training program. The Institutional Review Board at The Center for Outcome Analysis Human Subjects Division reviewed the approved the study protocols.

Seventy-eight participants consented to be in the study and completed the pre-assessment (time 1). Fifty-eight of those participants completed the course and post-assessment (time 2). Our sample size at follow-up of twenty-five participants is due to study attrition between post-assessment and follow-up (time 3). Reasons for the attrition included the participant leaving the company or not taking the follow-up assessment. The core study group of 58 participants was of similar demographics between intervention and control, with most participants being white females. The majority of both groups were employed as direct support professionals, or healthcare workers who work directly with people with physical, psychiatric, or cognitive disabilities or chronic illness to help them be self-sufficient. (Table 1). There were no significant differences between the intervention and control groups.

Study Design

Participants who consented to be in the study were placed into intervention or control groups. For one of the companies, the participants were assigned randomly. For the other company, participants from five different site locations were divided to achieve the most equal-sized groups (participants from two sites in one group and three sites in the other group). These two equal-sized groups were then randomly assigned to

Table 1 Participant characteristics at baseline

Characteristics	Intervention (%, $n = 25$)	Control (%, $n = 33$)	P value[a]
Gender (Female)	100%	80%	
Age			.36
18–24	26	30	
25–34	26	30	
35–44	9	8	
45–54	35	12	
55–64	4	20	
Race (white)	74	84	.40
Occupation			.89
Direct Support Professional	56	67	
Business	22	17	
Human Resources	11	17	
Food Services	11	0	
Reported having had back pain or know someone with back pain	91	93	.28

[a] P values were based on Chi-square test and Fisher's exact test for categorical variables, and t-test for continuous variables

intervention or control. The reason for this division by group was due to ease of course delivery for that company.

Procedures

The intervention took place on company computers. Participants were enrolled in a curriculum within their learning management system that included the links to the online pre-assessment, online course, and online post-assessment. After completing the pre-assessment at time 1, participants could then take the course assigned to him/her. Upon completion of the course, the participant was directed to take the post-assessment at time 2. Forty-five days after course completion at time 3, the participant received an email from the researcher with a link to the online follow-up assessment. The researcher re-sent the link to those who initially didn't complete the follow-up assessment, and the participants' supervisors also reminded them about the follow-up assessment.

The story-based video course delivered to the intervention group consisted of a 30-min online training module on back injury prevention. It started out with news music and the beginning of a fictional news talk show. The news show host introduced the topic of back pain and provided the viewers with some statistics about the high incidence of back injuries and the financial costs incurred due to back injuries. The host proceeded to interview a fictional orthopedic surgeon who talked about the anatomy of the back and what happens anatomically when there is a back injury. As the surgeon spoke about the anatomy, diagrams, key terms, and definitions appeared on the screen. The host had a jovial nature and provided casual commentary about back injuries such as, "back injuries are not fun *at all*," while sipping from his coffee mug.

The surgeon continued describing back injury prevention strategies along with some interactive screens where the learner needed to click on the answer to a question about back injuries. The course also included a fictional investigative reporter who, during a news break, interviewed persons in their job demonstrating back injury prevention no-no's such as poor posture and then corrected their behavior. The stories in this course met the criteria for increasing likelihood of successful behavior change (Glanz et al. 2008), stressing the importance of preventing back injuries and showing learners several ways that they could prevent such injuries.

The non-story-based video course delivered to the control group was created specifically for this study, included all the same basic content as the intervention course, and was similarly 30 min in duration. While this course had the same outline of content, the delivery differed. There were no news show format, fictional reporters or surgeons, or office-set vignettes demonstrating poor back injury prevention behavior. Rather, the content was delivered showing screens with diagrams and text with a background voice explaining the content. The course included the interactive questions but did not include any story-based video.

Measures and Analyses

Participants completed assessments before the course (time 1), immediately following the course (time 2), and at 45 days after the taking the course (time 3). (Table 2) The three assessments each included five multiple-choice questions to test back injury prevention knowledge. The questions included on the assessments were not the same exact questions at each time point but were of a similar nature, deemed by the researchers to be equivalent in difficulty and knowledge assessment, and all developed by subject matter experts during the course creation. Table 3 shows the relatively high correlation between study variables. Subject matter experts were the individuals who wrote the course content, ensured content met instructional design and e-learning standards/objectives, and ensured that the assessments measured course knowledge. The primary subject matter expert for this course has over 20 years of injury prevention content experience. All the questions related to course content were designed to measure knowledge gained from the course. Topic examples include how to properly lift an object, how to sit at one's desk in an ergonomic fashion, and personal risk factors for back injury. Time 1 also asked about demographic information, motivation to learn about back injury, and personal history of back injury. Time 2 also asked five Likert-type scale questions about the participant's experience and enjoyment taking the course and whether the course motivated them to engage in back injury prevention behavior. These questions were slightly modified questions from the E-Learning Usability Evaluation Questionnaire, a valid and reliable tool as evidenced by multiple empirical studies evaluating the tool in corporate environments (Zaharias and Poylymenakou 2009). Time 3 also included 6 Likert-type scale questions about current back injury prevention behaviors (Table 4).

To measure motivation, we compared the proportion of participants who were motivated to learn about back injury at time 1 versus time 2 using a chi-square test. While we asked about motivation using a scale, we dichotomized this variable for purposes of comparison between time 1 and time 2. We considered participants motivated at time 1 if they answered that they were "motivated" or "very motivated"

Table 2 Measures

	Time 1	Time 2	Time 3	Assessment Question Source
Day	1	2	45	
Sample size[a]	$n = 78$ (36i; 36c)	$n = 58$ (25i; 33c)	$n = 25$ (11i; 14c)	
Knowledge	X	X	X	Subject matter experts
Demographics	X			Behavioral risk factor surveillance system
Back injury history	X			Course content
Motivation	X	X		E-learning usability evaluation questionnaire
Engagement		X		E-learning usability evaluation questionnaire
Back injury behavior			X	Course content

[a] The letter "i" refers to the intervention group and "c" refers to the control group

(rather than "not motivated at all" or "a little motivated") to learn about back injury prevention. We used an answer from the modified E-learning Usability Evaluation Questionnaire at time 2 as a proxy for motivation to learn about back injury prevention. We considered participants motivated at time 2 if they agreed or strongly agreed with the statement, "The course stimulated further learning about back injury prevention." This measure is only a proxy for motivation to learn because the question referred to whether the actual course stimulated further learning about back injury prevention instead of whether the learner was motivated to learn more about back injury prevention, in general. See Table 3 for information about the correlation between study variables.

Next, we compared reported course engagement elements at post-intervention between the two groups using a chi-square test. We dichotomized responses about course engagement elements at time 2 for purposes of comparison between experimental conditions. The responses "agree" and "strongly agree" indicated positive responses (versus "neutral," "disagree," or "strongly disagree") to positive statements about the course such as, "The course was interesting." Lastly, we scored the knowledge questions as percentages correct at each of the time points. We ran a linear regression with the dependent variable being the

Table 3 Correlation matrix of variables

Variable	Knowledge T1	Knowledge T2	Knowledge T3	MotivationT1	MotivationT2
Knowledge T1	1				
Knowledge T2	0.79	1			
Knowledge T3	0.87	0.76	1		
Motivation T1	0.69	0.58	0.72	1	
Motivation T2	0.73	0.55	0.80	0.82	1

T1 = time 1; T2 = time 2, etc

Table 4 Representative questions from study measures

Knowledge

1. When lifting something, you should _____?
   a. Keep your feet far apart and bend at the waist to reach and lift.
   b. Keep your legs straight with your feet together and bend at the waist to pick it up.
   c. Keep your feet together, bend at the knees and squat until you are level with the object.
   d. Keep your feet shoulder-width apart, bend at the knees and squat until you are level with the object.
2. People between the ages of _____ are at higher risk for disc-related disorders.
   a. 13 and 21
   b. 21 and 30
   c. 30 and 60
   d. 60 and 80

Engagement

1. Rate your experience. The course incorporated novel characteristics.
   a. Strongly disagree
   b. Disagree
   c. Neutral
   d. Agree
   e. Strongly agree
2. Rate your experience. The course was enjoyable.
   a. Strongly disagree
   b. Disagree
   c. Neutral
   d. Agree
   e. Strongly agree

Motivation

1. How motivated are you to learn about back injury prevention?
   a. Not motivated at all
   b. A little motivated
   c. Motivated
   d. Very motivated
2. Rate your experience. The course stimulated further learning about back injury prevention.
   a. Strongly disagree
   b. Disagree
   c. Neutral
   d. Agree
   e. Strongly agree

score at time 2 and the predictors being the time 1 score and experimental condition. All analyses controlled for age and gender. We performed statistical analysis using StataSE version 15 (StataCorp LP, College Station, Texas, USA).

Results

Based on the regression analysis, there were no significant differences between groups in knowledge from pre-intervention to post-intervention ($b = .08$, $p = .12$) (Table 5). At 45-days follow-up, our t-test showed that non-story-based video based learners reported frequently or very frequently engaging in back injury prevention practices at more than double the rate of the story-based video learners ($p < .05$) (Fig. 1). The percentage of respondents who reported being motivated to learn about and engage in back injury prevention behaviors significantly increased from 73 to 92% for the control group, and decreased from 100 to 90% for the intervention group $X^2(1, N = 58) = 4.80$, $p < .05$ (Fig. 2). In the ratings of four different engagement elements (incorporating novel characteristics, enjoyability, being interesting, and stimulating further learning), we cannot conclude that the Likert-type scale responses differed between the intervention and control groups $X^2(1, N = 58) = 2.90$, $p = 0.57$ (Table 5).

Discussion

Our findings indicate that using a story-based video to deliver back injury prevention training may not correlate with greater motivation and knowledge than using a non-story-based video, and may be related to worse back injury prevention behavior. We found that increased learner enjoyment, interest in course content, and knowledge may not correspond with taking a course that uses story-based video instead of non-story-based video.

The lack of evidence shown here that story-based video increases motivation, engagement, and knowledge regarding back injury prevention is important knowledge

Table 5 Statistical results

Linear regression to predict knowledge at post-test [a]				
	B [d]	*β*[e]	*p*-value	*df*
Constant	3.77		< .001	24
Knowledge at time 1[b]	0.08	0.06	.12	
Story-based video condition[b]	−0.31	−0.10	.11	
Age [c]	1.71	0.80	< .001	
Gender [c]	0.09	0.05	.31	
Chi-square to compare intervention group[b]				
	X^2		*p*-value	*df*
Motivation[a]	4.80		.03	58
Engagement[a]	2.90		.57	58

Controlled for age and gender

[a] Dependent Variable

[b] Independent Variable

[c] Control variable

[d] Non-standardized Coefficient

[e] Standardized Coefficient

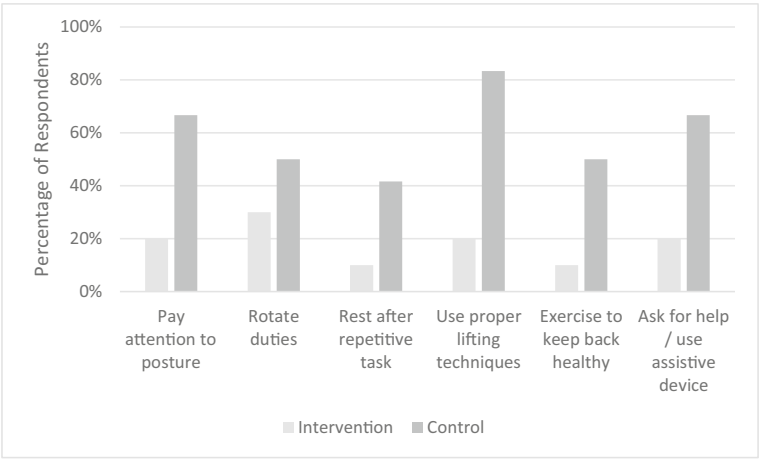

Fig. 1 Percentage of participants who engage in back injury prevention behaviors frequently or very frequently at 45-day follow-up

for online health and safety training developers and the employers who purchase such training to train their workforce. Developing story-based video content uses significantly more resources than developing similar courses that do not involve a storyline and advanced video techniques. This study supports employers offering well-designed employee health and safety courses that may not have expensive features. Most participants in this study reported being motivated to learn about back injury prevention and either had back pain or knew someone with back pain at the start of the study. It is possible that a group less motivated to learn about or aware of a health and safety topic may benefit more from a story-based video training.

One possible explanation for our finding that motivation to learn about and engage in back injury prevention behaviors decreased for the story-based video group but increased for the non-story-based video group after taking the course is that the

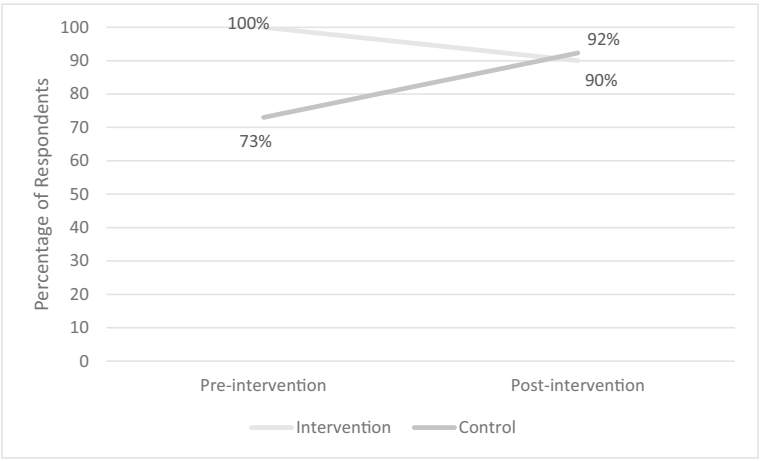

Fig. 2 Change in motivation to learn about and engage in back injury prevention behaviors from pre-intervention to post-intervention

entertaining aspect of the story-based video may have overshadowed the seriousness of the topic. There is a growing body of literature showing the importance of balancing serious and fun digital content in training targeting behavior change. (Thompson 2012; Guillén-Nieto and Aleson-Carbonell 2012). A second explanation is a ceiling effect at the start of the study. The story-based video training group was 100% motivated at the start of the study. This limited the range of data that we could collect about the intervention group's level of motivation. We recommend that a future study examine motivation to learn about back injury prevention using a more sensitive survey instrument.

A third possible explanation for our counterintuitive findings may be due to the nature of the stories within the course offered in this study. Much of the prior research on story-based training uses real-life true injury stories within training (Cullen 2008; Ricketts 2015; Ricketts et al. 2010). The course in this study used fictional stories. While there is a lack of research comparing using true injury stories to fictional injury stories, it is possible that true injury stories evoke greater emotion in learners. Evoking emotion is one of the ways stories effectively train learners (Green and Brock 2000). Smith-Jentsch et al. (1996) describe the value of negative pretraining events. When learners experience, or even see, a negative event resulting from a behavior, they may be more motivated to learn about that topic to avoid that event in the future. Ricketts (2015) suggests the following sources for finding true injury cases to incorporate into training: 1) reports from occupational health agencies (e.g., NIOSH, OSHA); 2) medical and scientific journals; 3) workers compensation authorities; and 4) news outlets. It is important to note that our study examined just one type of story-based training. There could be other types of story-based training that are effective.

A fourth possible reason that the story-based video course didn't seem more effective is that the news show format may have been too distracting. Stories can become distracting if the stories themselves or their presentation is irrelevant or too detailed (Rey 2012). The course included news music, several changes in setting from the news room to offices, and a jovial host. Perhaps another course with less distraction would allow the learner to imagine more, mentally completing the story and messages with their own experiences.

Along with promoting quality courses, employers can implement other strategies to help improve back injury prevention such as workplace exercise programs, employee back pain screening, and optimally organizing workflow to minimize heavy lifting. (Occupational Safety and Health Administration 2017; Canadian Centre for Occupational Health and Safety 2017; Maher 2000). Employers may also want to consider a blended learning approach, which has been shown to be effective and utilizes multiple platforms for delivering training content. Blended learning strategies may include but are not limited to offering hands-on practical application, print-based materials, and mentor-based instruction (Milanese et al. 2014; Lothridge et al. 2013).

Limitations

One limitation of this study is the small follow-up (time 3) sample size. In workplace interventions, it is difficult to obtain the time from study participants to complete

multiple assessments (O'Donnell 2014; Robson et al. 2012), so we proceeded with the study despite the lower turnout between time 2 and time 3 to learn as much as possible to help inform other researchers and online education developers. The small sample size led to low power and affects the reliability and generalizability of our follow-up findings. Furthermore, had this study had more participants, we could have controlled for the organization since one organization had random selection and one did not. We recommend future research on this topic using more participants. Another limitation is that participants were employed by the company who made the course available to them. Due to this relationship, their answers about the course could be biased. To help prevent this reporting bias, the researchers directly collected the responses and notified the participants up front that we would not share any of the individual data with their employers.

There are limitations related to the measures over time. Participants were asked about their back injury prevention behaviors only at follow-up so we could not assess their change in reported behaviors over time. The differences seen here could be due to pre-existing differences. The reason we did not ask about these behaviors on the pre-assessment is that we chose to ask instead about knowledge, motivation, and demographic characteristics. We predicted challenges with participant compliance from performing other studies in workplace settings and wanted to minimize the time burden in completing assessments. Furthermore, researchers may want to focus on ensuring high equivalency of measures across time points in future related studies. Given the specific nature of measuring knowledge obtained from one course, this may entail a preliminary analysis focused on validity and reliability of measurement tools prior to the intervention study.

Conclusions

Employers need cost-effective strategies for preventing back injuries among their workforces. Replication of this study's results using a larger, more diverse sample examining a variety of course topics would help identify opportunities to optimally improve back injury prevention through relatively low-cost online training courses. Researchers and employers should examine the effectiveness of story-based video for other health and safety areas such as work stress, chemical hazards, and workplace violence to help determine whether there are certain topics or target employee populations where an investment in story-based video technology is advantageous.

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