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A Comparison of "Train-the-Trainer" and Expert Training Modalities for Hearing Protection Use in Construction

Maggie Trabeau, MS,[1] Richard Neitzel, MS,[1] Hendrika Meischke, PhD,[2] William E. Daniell, MD, MPH,[1] and Noah S. Seixas, PhD[1]*

Background *Few assessments have been conducted on the impact of a "Train-the-Trainer" (T3) approach for training delivery. The present study compared the effectiveness of a noise induced hearing loss (NIHL) prevention training delivered using "Train-the-Trainer" and expert trainer modalities.*

Methods *Participating construction companies were assigned to the Train-the-Trainer or expert trainer modalities. Workers were recruited from each company and then trained. The effectiveness of the modalities was assessed through the use of surveys. The accuracy of self-reported hearing protection device (HPD) use was also evaluated through on-site observation.*

Results *Post-training scores for hearing conservation knowledge, perceived barriers, and current and intended future use of HPDs improved significantly for both training modalities. Subjects trained by T3 trainers significantly increased their beliefs regarding general susceptibility to NIHL, desire to prevent NIHL, and ability to recognize, and control hazardous noise exposures. The expert-trained groups significantly increased their beliefs regarding the benefits of HPD use and ability to ask for help with HPDs. The only changes that were significantly different between modalities were in general susceptibility to NIHL and effective use of HPDs. However, these beliefs differed significantly between subjects in the two-modality groups prior to training. Self-reported HPD use was poorly correlated with observed use, calling into question the validity of survey-based HPD use measures in this context.*

Conclusions *The training improved beliefs regarding HPD use, increased workers' hearing conservation knowledge, and increased self-reported HPD use. The effectiveness of the training was not found to be dependent on training modality.* Am. J. Ind. Med. 51:130–137, 2008. *© 2007 Wiley-Liss, Inc.*

KEY WORDS: hearing conservation; Train-the-Trainer; training effectiveness; hearing protection; Health Promotion Model

[1]Department of Environmental and Occupational Health Sciences, University of Washington, Seattle, Washington

[2]Department of Health Services, University of Washington, Seattle, Washington

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Maggie Trabeau's present address is Sabre Technical Services, Watervliet, NY

*Correspondence to: Noah S. Seixas, Department of Environmental and Occupational Health Sciences, University of Washington, 4225 Roosevelt Way NE, Suite 100, Seattle, WA 98105-6099. E-mail: nseixas@u.washington.edu

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INTRODUCTION

Exposure to high levels of noise in the construction industry is well documented, however the intermittent and unpredictable nature of noisy tasks during construction work makes it very difficult to use engineering controls to reduce a worker's noise exposure. Until more effective engineering controls become commonplace within the construction industry, the prevention of noise induced hearing loss (NIHL) among construction workers depends on the ability of workers to recognize when they are exposed to hazardous noise levels ($\geq$85 dBA), and to know how to protect themselves. In order for workers to have the necessary knowledge and motivation to protect themselves, they must be effectively trained on noise hazards and methods of protection, including effective use of hearing protection devices (HPDs).

In response to this need, the University of Washington has developed a hearing protection-training program for construction workers. The training program is a one-hour oral presentation that was designed using a modified Health Promotion Model (HPM) for guidance. This model has proven useful in previous studies of hearing protection use [Lusk et al., 1999]. The eight components of the adopted model included five belief factors (perceived susceptibility, severity, benefits, barriers, and self-efficacy), two HPD use cofactors (interpersonal norms, situational influences), and one knowledge factor. The goal of the training program is to increase HPD use by affecting each of these model components with regard to HPD use. Specifically, the perception of the severity of noise exposure is addressed by illustrating how exposure to hazardous noise levels affects hearing and the impact that a NIHL could have on the quality of one's life. Susceptibility to NIHL is addressed by reviewing and demonstrating noise levels of tools commonly used on construction sites. An in-depth review of the HPDs that are available and the pros and cons of each type, coupled with a hands on demonstration on the proper selection, fit and care of HPDs is incorporated to improve perceived benefits of HPD use and belief that they can effectively be worn to prevent NIHL (self-efficacy) while simultaneously reducing any perceived barriers for using HPDs. Further description of the development and initial testing of the training program, and its basis in the HPM, is described elsewhere (Neitzel et al., 2007).

Widespread dissemination of this training program will ultimately rely on its adoption by individual trainers within the construction industry who have been trained in its effective delivery. This format of training is known as a ''Train-the-Trainer'' (referred to here as ''T3'') approach and is frequently used by unions, community organizations, private industry, and by U.S. government agencies [Orfaly et al., 2005].

Despite its widespread use and potential benefits, the effectiveness of the T3 approach has not been adequately evaluated. When trainers are involved in the design and delivery of a training program they are more effective in transmitting their newly acquired knowledge [Kurtz et al., 1997; Levy et al., 1999; Hinds et al., 2001; Hahn et al., 2002; Sanddal et al., 2004; Orfaly et al., 2005]. If the trainers are provided with previously developed material, as is the case in our program, less is known about the T3 trainer's effectiveness.

To evaluate the impact that the ''T3'' approach has on the effectiveness of the training program, construction workers were recruited from a number of regional construction companies to participate in a NIHL prevention training session provided by either the newly trained individual from the industry or an NIHL expert. The effectiveness of each training modality (T3 vs. expert) was assessed by comparing the change in beliefs regarding HPD use, knowledge of noise, and HPD use information, intent of the workers to use HPDs, and self-reported use of HPDs when exposed to hazardous noise levels. These intermediate outcomes are thought to be predictive of long-term outcomes such as the reduction of injury and illness of workers which are not always readily measurable due to the immediate evaluation needs of training interventions and the availability of resources [NIOSH 1999]. In the process of comparing training modalities, the accuracy of self-reported HPD use was also assessed. The evaluation described here is part of a larger University of Washington study designed to assess the effectiveness of three different intervention strategies (one-time worker training, bi-weekly refresher training sessions, and use of a personal noise indicator device).

MATERIALS AND METHODS

Site and Subject Selection

Companies participating in the study were recruited from a group of contractors involved in the development of a construction-specific hearing conservation program by the Associated General Contractors (AGC) of Western Washington. Participation required that a company have a site with an adequate number of long-term employees in the early stages of construction available within the area. Each site was assigned to the T3 or expert modality. On each T3 site, the trainer was identified by the company based on their role within the company for health and safety. Alternatively, the trainer was the safety director for the local AGC.

There were four T3 trainers and one NIHL expert who participated in this study as trainers. The T3 trainers had experience in construction ranging from 4 to 25 years. The NIHL expert who participated in the study was a research industrial hygienist associated with the University of Washington with over 8 years experience assessing noise and hearing conservation practices. With the exception of one T3 trainer who has 15 years of training experience, the majority of trainers had approximately 5 years of experience, and all

but one of the T3 trainers had had NIHL training within the last 5 years.

All together, 13 training sessions were held for nine separate companies and 135 workers. The T3 trainers held six training sessions for a total of 72 workers. The NIHL expert held 7 sessions for 63 workers. With the exception of one T3 trainer who trained on three separate occasions, each of these trainers delivered the training program one time. Only two of the nine companies hosted more than one training session for its workers. One of the companies held two separate training sessions with one of the trainers while the other company held four separate training sessions with the NIHL expert. The average duration of each training session was 52 ($\pm$8) min.

On each site, participants were recruited from current employees by study personnel in cooperation with the site safety supervisor. Potential subjects were provided with information about the study procedures and asked to volunteer. Volunteers were asked to sign an informed consent letter. A $20 incentive was paid to each worker for each day that they completed a study-related activity (survey, dosimetry, and activity card). All procedures were approved in advance by the University of Washington Institutional Review Board.

Training Sessions

Training sessions were designed for oral presentation in under 1 hr with the use of flip-chart visual materials and two physical demonstrations. The program was specifically designed to address elements of the revised Health Promotion Model: perception of susceptibility, severity of hearing loss, benefits of using HPDs, self-efficacy for effective use of HPDs and perceived barriers to HPD use. The conceptual basis, development and initial testing of the training program are described elsewhere [Neitzel et al., 2007].

T3 trainers received training on how to present the program a month or more before the worker training session. The NIHL expert demonstrated how the training session should be presented, instructed the T3 trainers on the specific information that should be covered during the training session, and provided more in-depth information to build the T3 trainers' knowledge and understanding of the subject. Additional information included the principal messages and concepts behind the training, the Washington State standards for noise exposure, the pros and cons of HPD use, information on the specific types of HPDs that should be provided as part of the training, and the mechanics of hearing loss, and noise level measurements (dosimetry, noise level meter, decibel level scale, etc.). Following their instruction, each trainer was asked to present a portion of the training session to the class. The class then discussed areas of improvement for each section and addressed any remaining questions. The trainers were given a copy of the training manual used during the class and a CD with a copy of the training presentation. This training session helped ensure a basic level of information common to each of the individual T3 trainers.

Workers were given the training program on their worksite during paid work time. The actual duration of the training presentation and the use of presentation materials was determined by the individual trainer.

Surveys

The survey instrument was administered to each participant three times: before the training session, immediately after the training session, and 2 months after the training session. The survey included several sections: subject demographics, beliefs associated with the health belief model characteristics (susceptibility, severity, benefits, self-efficacy, and barriers), co-factors believed to have a potential impact on beliefs (e.g., subject demographics, interpersonal influences, HPD climate, etc.), knowledge of noise and HPD use, and use of HPDs (intended and actual). Beliefs and the cofactors of interest were assessed on a standard 5-point Likert scale with 1 corresponding to ''Strongly Disagree'', 3 ''Not Sure'', and 5 ''Strongly Agree''. The questions for intent and current use of HPDs were on a 4-point scale with 1 corresponding to ''$<$10%'', 2 ''10–50%'', 3 ''51–90%'', and 4 ''$>$90%''.

Observations and Noise Measurements

Study staff observed each training session to document factors believed to have the potential to impact training effectiveness (e.g., class size, length of session, etc.) and to document how well each trainer adhered to the training program curriculum. All observations were documented using a standardized form.

During the 2 months between the completion of the first and second post-training surveys, a subset of subjects was asked to fill out an activity card, and wear a noise dosimeter for one workday. The activity card allowed workers to report when they used hearing protection and the type of HPD they used. The dosimeter was used to record what the worker's actual noise exposures were throughout the day and was programmed to calculate the worker's average noise exposure as described earlier [Seixas et al., 2005]. Observations were also made of each subject by study staff. Observers randomly walked the worksite and made 4–7 independent observations of each worker's use of HPDs. The observations were later linked to the task-card and dosimetry files to determine the accuracy of their self-reported HPD use.

Data Analysis

Data were analyzed using STATA^{TM} statistical software (Intercooled Stata 9.1 for Windows). All data were checked and recoded as necessary for analysis.

Cronbach's alpha was used to determine the coherence of questionnaire items designed to address individual concepts. The five items related to barriers to HPD use had a Cronbach's alpha of 0.6; all other proposed item groups had lower alphas. Barriers was the only conceptual grouping that was retained for analysis, because of its moderate coherence and the intuitive integrity of this item group. The remaining beliefs questions were analyzed separately.

The change in beliefs and knowledge of HPD use between each of the surveys was determined for each subject. These changes were then stratified by training modality (T3 vs. expert), and a one-sample *t*-test was calculated to determine if the mean change was statistically different from zero. Two-sample *t*-tests with equal variance were used to determine if these changes were significantly different between modalities. The relationship between outcomes (change in beliefs, knowledge or HPD use) and subject demographics or cofactors were evaluated with a Spearman correlation coefficient or analysis of variance. The relationship between the changes in intent to use HPD, self-reported use of HPD, and training modality was examined with the use of contingency tables and a Chi-square test. Changes in knowledge and beliefs were assessed from baseline (Survey 1) to post-training (Survey 2) and to the 2-month follow-up (Survey 3). However, we report here mainly the change from Survey 1 to 3 because it better reflects long-term effect of the intervention.

Self-reported use and intent to use HPDs was validated by comparing the survey reports with data from the workers' activity cards, and observations of HPD use by study staff. In particular, HPD use reported on the activity card was categorized as $<10\%$, 10–50%, 50–90% or $>90\%$ of the time when over 85 dBA. These data were then compared with the observed use by study personnel, the reported use on the third survey, and intended use reported on the second survey. The level of agreement between each form of HPD use reporting was evaluated using a kappa statistic for each comparison.

RESULTS

All but one of the training sessions were held in controlled environments (conference room or site trailer). The majority of these training sessions were held in makeshift conference rooms located on the construction sites. The training sessions all followed the entire training program format as outlined by the University of Washington, with deletion of sections not relevant to a particular worksite.

In total, 135 subjects were enrolled in the study. However, 32 subjects (15 T3; 17 Expert) left their worksites prior to the 2-month follow-up and either could not be reached or did not return the follow-up survey. The workers that were lost to follow-up were more likely to have had previous NIHL training (68% among lost to follow-up vs. 40%) and experienced symptoms of tinnitus (94% among lost to follow-up vs. 78%). There were no other significant differences. Analysis is based on the 103 subjects for whom all three surveys were available.

Subject demographics are presented by training modality in Table I. The majority of the subjects were men, were approximately 40-years old, had a high school education, and spoke English as their primary language. Subjects in the T3 group were more likely to be carpenters (53% vs. 33%) and had slightly more years of construction experience (20.5 vs. 16.6 years).

At baseline (before training), each group had similar responses for most of the outcome measures (Table II). However, the group trained by the expert had significantly higher beliefs regarding general susceptibility to noise induced hearing loss and effective use of HPDs to prevent NIHL (self-efficacy; hazard control).

Scores for noise and HPD knowledge were significantly increased from baseline to Survey 3 for both training modalities (Table III). The T3 trainers also increased their scores for general susceptibility, severity (prevention), and self-efficacy (hazard recognition and control). The expert trained group had an increase in perceived benefits of HPD use and self-efficacy (assistance availability). Both groups had a significant decrease in the perceived barriers to HPD use. In general, the largest changes were observed between the first and second survey (data not shown). Two outcome measures (barriers and knowledge) demonstrated a small decrease when measured again 2 months later (Survey 3), while the other measures showed little additional change.

The T3 group demonstrated a significantly greater increase in general susceptibility and self-efficacy for hazard control from Survey 1 to 3. No other variables had a significant difference in change between training modalities.

Analysis of the change in the worker's intent to use HPD between surveys showed that 40% of the workers trained by the T3 trainers, and 38% of the workers trained by the NIHL expert, had an overall increase of intent to wear HPD when exposed to high noise levels (Table IV). Reported use of HPD saw similar increases; 36% for the T3 group and 43% for the expert group.

In total, there were 58 individuals (43% of those trained) for whom on-site observations were made. With the exception of the workers from Sessions C and F, data were collected 36 ($\pm$13) days before Survey 3 was administered. Data for Session C and F workers were collected the day before, or on the day that Survey 3 was administered. The sum of observation periods within a workday averaged 60 ($\pm$18) min per worker. The average L_{eq} noise exposure level for all workers was calculated to be approximately 87 ($\pm$4.5) dBA for one 8-hr work shift and did not differ between training modality groups.

Comparison of the frequency of HPD use reported on the activity cards to staff observations showed that the two

TABLE I. Subject Demographics by Training Modality

Demographic		n	Train-the-Trainer	n	Expert	*P*-value
Age (years)	Mean (std. dev.)	56	41.1 (9.6)	45	38.0 (9.7)	0.11[b]
Gender	Male	56	98%	43	93%	0.21[a]
Education level (years)	Mean (std. dev.)	56	12.2 (1.0)	38	12.7 (1.2)	0.11[b]
Primary language	English	53	93%	44	98%	0.26[a]
Years in construction	Mean (std. dev.)	55	20.5 (9.5)	37	16.6 (8.4)	0.04[b]
Trade	Carpenter	28	53%	15	33%	
	Laborer	13	25%	9	20%	0.04[a]
	Operating Engineer	3	6%	10	22%	
	Other	9	17%	12	26%	
Previous NIHL training	Yes	21	37%	20	43%	0.49[a]
Hearing ability	Good	22	40%	22	49%	
	Fair	28	51%	19	42%	0.66[a]
	Poor	5	9%	4	9%	
Use of hearing aid	Yes	1	2%	3	7%	0.21[a]
Family history of HL	Yes	7	13%	10	22%	0.23[a]
Tinnitus	Never	11	20%	11	24%	
	Rarely/Sometimes	38	68%	28	62%	
	Frequently	6	11%	5	11%	0.94[a]
	Always	1	2%	1	2%	

[a] Chi-square test.
[b] Two-sample *t*-test, with equal variance.

measures of HPD use had moderate agreement (kappa 0.60) (Table V). It is notable that three subjects who reported HPD use >90% of the high exposure time were observed actually using HPDs <10% of the time in high noise. Comparison of self-reported use on the activity cards to use reported on the last survey (Survey 3) showed poor agreement (kappa 0.12). Self-reported use of HPDs in Survey 3 was higher than what was reported on the activity cards for 57% of the workers. Intent to use HPDs, as reported on Survey 2, also had poor agreement with use reported on their activity cards (kappa = 0.14). Seventy percent of the subjects did not use their HPDs as they had indicated they would in the survey.

DISCUSSION

Results of this study indicate that the hearing conservation training improved beliefs regarding HPD use, increased the workers' knowledge about noise exposures, and increased self-reported use, and intent to wear HPDs.

The study found no significant differences between Expert and T3 groups except on two outcomes. These two items differed between groups at baseline despite random assignment of training modalities to sites. The initial average scores for susceptibility (general) and self-efficacy (hazard control) among those trained by the T3 trainers started at a significantly lower point than those trained by the NIHL expert which were almost at the highest score possible on the Likert scale (Table II). This left more room for improvement in scores among those trained by the T3 trainers than those trained by the NIHL expert.

Both training modalities were found to be equally effective in increasing the workers' knowledge regarding recognition and control of hazardous noise exposures and decreasing the workers perception of barriers to HPD use. This effect was largely stable over the 2-month post-training period, however the scores for barriers, and knowledge did show some decline from Survey 2 to 3 (data not shown). The decrease in the overall change for some of the outcome measures over time is not unexpected. The attenuation of the effects of one-time interventions over time has been documented in other areas of health behavior research [Eppler et al., 1994]. These findings further emphasize the potential need for other components of training incorporated in the larger University of Washington study which uses a three-pronged approach to behavior change in order to sustain the impact of the training intervention over time; specifically, the one-time training program is augmented with bi-weekly reinforcement training and the use of a noise indicator to alert the wearer to hazardous noise levels.

Approximately 39% of the workers reported increased use of HPDs after the training intervention (Table IV). However, HPD use reported on the survey matched poorly with that reported on the worker's activity cards (Table V). Fifty seven percent of the workers over-reported their HPD use in the survey when compared to use reported on the activity cards. Self-reported use of HPD on surveys given to

TABLE II. Average Response for Each Outcome Measure Prior to Training (Survey 1) Stratified by Training Modality

		Train-the-Trainer			Expert			
Analysis category	**Survey question**	**n**	**Mean**	**Std. Dev.**	**n**	**Mean**	**Std. Dev.**	***P*-value[a]**
Knowledge		57	0.69	0.15	46	0.73	0.14	0.19
Susceptibility								
Without a hearing protection device	My hearing will not be affected by noise, even if I don't wear hearing protection[b]	56	4.32	1.24	45	4.51	1.14	0.43
General	I believe exposure to loud noise can hurt my hearing	54	4.24	1.49	46	4.76	0.85	0.04
Severity of hearing loss								
Communication	It would be harder for me to understand what people say if I lost some of my hearing	55	4.45	1.26	45	4.38	1.37	0.77
General	It wouldn't be a big problem for me if I lost some of my hearing[b]	56	3.93	1.59	46	4.06	1.54	0.66
Prevention	Preventing hearing loss is very important to me	56	4.46	1.04	46	4.78	0.51	0.06
Benefits	Wearing hearing protection protects me against hearing loss from noise	56	4.62	0.82	45	4.64	0.77	0.90
Barriers	Wearing hearing protection can make it easier for me to hear machinery or talk to coworkers[b]	50	2.78	0.69	45	2.60	0.81	0.24
	Wearing hearing protection makes it very hard to talk to people							
	It takes too much time to use hearing protection							
	Wearing hearing protection is unsafe because it blocks out danger signals							
	Hearing protectors are too uncomfortable for me to wear							
Self-efficacy								
Hazard recognition	I can tell when I need to wear my hearing protection	56	4.36	0.77	46	4.39	0.65	0.81
Hazard control	I know how to wear my hearing protection correctly	57	4.23	1.05	45	4.69	0.51	0.01
Assistance availability	I am sure I can ask for help if I have a hard time wearing hearing protection	53	4.32	0.78	45	4.29	0.94	0.85

All outcomes were measured on a 5-point scale.
[a]Two-sample *t*-test, with equal variance.
[b]Likert scale was reversed for analysis.

construction workers was also over reported in a similar study designed to assess the effectiveness of HPD among construction workers [Neitzel and Seixas, 2005].

HPD use reported on the activity card data appears to be quite accurate, both here (Table V) and in other observational studies [Neitzel and Seixas, 2005]. Unfortunately, the current study included task-cards and observations on a subset of the subjects and only after the training, so they could not be used directly to assess change in behavior. As a result, this study relied on self-reported use and intent to use.

Among blue-collar workers in a fixed-site industry, self-reported use on surveys was shown to be accurate and reliable [Lusk et al., 1995]. However, the accuracy of self-reported HPD use may not be the same in a variable noise environment such as construction, which also has not had a long-standing culture of HPD use. Although self-reports were used to demonstrate the effectiveness of an HPD use intervention in construction, the self-reports were not validated with observations in that study [Lusk et al., 1999].

Behavioral intent is listed by NIOSH as a measure of training program effectiveness [NIOSH 1999]. Though the current study was successful in increasing the intent of approximately 39% of the workers to wear HPDs when exposed to hazardous noise levels, comparison of the workers intent to their actual use, as reported on their activity cards, shows a very low level of agreement between the two (Table V). Though the data from this study are limited, this finding does draw into question the use of intent to use HPDs as a measure of training effectiveness, and it remains unclear if the training in this study actually changed behavior. The larger study, in which task cards, and observations are available both before and after training, will address the behavioral effect of the intervention and the meaning of the intent to use.

TABLE III. Overall Change (Survey 3-1) in Outcome Measures Stratified by Training Modality

	Train-the-Trainer				Expert				
Outcome measure	**n**	**Mean**	**Std. Dev.**	***P*-value[a]**	**n**	**Mean**	**Std. Dev.**	***P*-value[a]**	***P*-value[b]**
ΔKnowledge	57	0.10	0.14	<0.001	45	0.10	0.19	0.001	0.95
ΔSusceptibility									
Without a hearing protection device	56	0.30	1.42	0.12	45	0.15	1.02	0.31	0.56
General	54	0.50	1.45	0.01	45	−0.18	1.25	0.34	0.01
ΔSeverity of hearing loss									
Communication	55	0.16	1.67	0.47	45	0.24	1.45	0.26	0.80
General	56	0.14	2.13	0.62	46	−0.19	1.83	0.47	0.40
Prevention	55	0.33	1.12	0.03	46	0.04	0.42	0.48	0.11
ΔBenefits	56	0.16	0.68	0.08	45	0.27	0.89	0.05	0.50
ΔBarriers	49	−0.43	0.78	<0.001	41	−0.36	0.93	0.01	0.71
ΔSelf-efficacy									
Hazard recognition	56	0.37	0.92	0.004	45	0.20	0.87	0.13	0.33
Hazard control	57	0.63	0.97	<0.001	45	0.11	0.65	0.25	0.003
Assistance availability	53	0.19	0.96	0.16	45	0.42	1.14	0.02	0.27

A positive mean indicates an increase in score from Survey 1 to Survey 3.
[a]Two-sample *t*-test, with equal variance applied to the mean within each modality.
[b]Two-sample *t*-test, with equal variance for comparison of T3 and Expert modality means.

The training program included specific material to help workers recognize when their noise exposure exceeds 85 dBA. Nevertheless, the inability to judge when they were exposed to 'high noise' could contribute to the discrepancy between self-reports and task-cards. Workers were shown the average noise levels of tools frequently used on a construction site and given a demonstration of the noise levels associated with common construction tools. Additional efforts to address this issue have also been made within the larger study by use of a noise indicator to alert the wearer of hazardous noise levels.

The results of this study have several limitations. First, generalizability may be limited by recruitment only from within large commercial contractor workforces, and because about one quarter of the workers originally enrolled were lost to follow-up. This level of attrition is not unexpected among a group of construction workers over a 2-month period because of the transience of work assignments in the industry. Nevertheless, we did find some small differences in hearing and previous training in those that were lost to follow-up compared to those that completed the study. These differences are unlikely to bias the T3 versus expert training comparisons reported here.

TABLE IV. Overall Change in Intent to Use and Use of HPD When Exposed ≥85 dBA (Survey 3-1)

	Train-the-Trainer		Expert		
Type of change	**n**	**%**	**n**	**%**	***P*-value[a]**
ΔIntent					
Increase	21	40	16	38	
No change	25	48	22	52	0.90
Decrease	6	11	4	9	
ΔHPD use					
Increase	19	36	19	43	
No change	25	47	20	45	0.65
Decrease	9	17	5	11	

[a]Chi-square test.

Second, the analysis assumed that each individual worker's response to training was independent of other workers. This assumption is not rigorously correct, given the possible influence they would have on each other at the training session, and while working on a worksite. However, construction workers work relatively independently and are probably less likely to be influenced by such pressures than in other industries. Further, any non-independence within worksite would likely overstate the differences observed. Because our primary results were null, this potential bias is less important for our findings.

Third, despite designing the training materials and questionnaire on the elements of the Health Promotion Model, the individual questionnaire items had lower than expected coherence as measured by Cronbach's alpha. As a result, most constructs were analyzed as single item responses. The five items designed to assess barriers to HPD use had an alpha of 0.6, and were analyzed as a grouped variable because of this modest correlation, and the intuitive coherence of the individual items.

TABLE V. Validation of HPD Use Reporting When Exposed ≥85 dBA

		HPD use reported on activity card				
	% of time	<10%	10–50%	51–90%	>90%	Total
kappa = 0.60						
Observed HPD use by staff	<10	30	2	0	3	35
	10–50	0	0	1	0	1
	51–90	0	0	0	1	1
	>90	0	2	1	10	13
	Total	30	4	2	14	50
kappa = 0.12						
HPD use reported in Survey 3	<10	3	0	0	0	3
	10–50	8	1	3	1	13
	51–90	13	3	2	4	22
	>90	4	1	2	9	16
	Total	28	5	7	14	54
kappa = 0.14						
Intent (Survey 2)	<10	0	0	0	0	0
	10–50	4	1	0	2	7
	51–90	13	2	3	0	18
	>90	11	2	3	12	28
	Total	28	5	6	14	53

Note: Each number represents the number of subjects within each category.

The results of this study indicate that widespread dissemination of this training program by T3 trainers will not significantly impact its effectiveness, assuming the trainers are given adequate training on its effective delivery. Proper grounding of the training program in health education theory helps to insure that the messages are appropriately targeted and received.

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