

# Impact of a Lead-Safe Training Program on Workers Conducting Renovation, Painting, and Maintenance Activities

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## SYNOPSIS

**Objective.** An important source of lead exposure is lead-based paint that is disturbed when unsafe work practices are used during renovation, remodeling, and maintenance activities. This study explores the success of a pilot lead-safe skills training program for home improvement contractors and their employees (including renovators, remodelers, and painters) and small property owners.

**Methods.** The study evaluates whether attendees at eight-hour lead-safe work practices training courses learned and retained information about lead exposure; developed and retained positive attitudes toward lead-safe work practices; and developed lasting, positive behavioral intentions to use lead-safe work practice skills and techniques. A questionnaire was administered immediately before, immediately following, and several months following the training program. Coded data from the questionnaires were analyzed using SPSS software.

**Results.** Respondents showed statistically significant changes from before to after the training program, and the changes were maintained over time. Knowledge improved, and attitudes and behavioral intentions changed in a favorable direction.

**Conclusion.** These results suggest that lead-safe training can be successful and can create lasting changes in lead-safe knowledge, attitudes, and behaviors.

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Since the mid-1970s, the blood lead levels of children in the United States have dropped significantly.<sup>1</sup> This success has resulted in a shift in priority from a secondary prevention strategy (i.e., early detection and treatment of lead poisoning) to a primary prevention strategy (i.e., prevention of lead poisoning). The strategy is intended to further the attainment of the major goal of eliminating childhood lead poisoning in the U.S. by the year 2010.<sup>2</sup>

National data suggest that almost 900,000 children in the U.S. have blood lead levels exceeding the Centers for Disease Control and Prevention's (CDC's) level of concern,  $\geq 10\mu\text{g}/\text{dL}$ .<sup>3</sup> According to Connecticut Department of Public Health (DPH) data, more than 400 children younger than age 6 were identified with elevated blood lead levels, defined as  $\geq 20\mu\text{g}/\text{dL}$  of whole blood, in Connecticut in 1999. The exposure pathways that contribute to this condition are diverse but are thought to be primarily related to lead-contaminated dust and soil.<sup>4</sup> One important source of lead is the release of lead dust or paint chips as the result of unsafe work practices during renovation, remodeling, and maintenance activities. A recent study sponsored by the Environmental Protection Agency (EPA) to evaluate the risk for lead poisoning related to renovation and maintenance procedures, found that the risk for children who reside in a home where renovation is occurring is 1.3 times that of children who are not so exposed.<sup>5</sup> This study also suggests that work performed by owners of small properties and do-it-yourselfers could significantly elevate risks for children who reside in those dwellings. Additionally, such renovation and maintenance activities may be sources of lead exposure for workers and worker's families via take-home contamination.

Federal regulations have stressed the need for trained and competent professionals in the home improvement and painting industries. On September 15, 1999, the U.S. Department of Housing and Urban Development (HUD) issued *Requirements for Notification, Evaluation, and Reduction of Lead-Based Paint Hazards in Federally Owned Residential Property and Housing Receiving Federal Assistance*. This new regulation is designed to protect young children from lead-based paint hazards in housing that is financially assisted by the federal government. The regulation requires that contractors and property owners be trained in lead-safe work practices when they perform repairs, maintenance, painting, rehabilitation, remodeling, or renovation in federally assisted housing built before 1978.

Additionally, on June 1, 1999, the EPA issued *Lead: Requirements for Hazard Education Before Renovation of Target Housing*. This regulation requires that renovators, painters, and home improvement contractors notify owners and occupants before conducting renovations in pre-1978 housing. They are also required to distribute a lead hazard information pamphlet to owners and occupants.

In response to these regulatory changes, the Connecticut DPH sponsored a pilot series of training courses directed toward renovators and remodelers. The training programs used a modified version of the EPA/HUD training protocol developed by the National Environmental Training Association, *Lead-Based Paint Maintenance Training Guide: Work Smart, Work Wet, and Work Clean to Work Lead Safe*.<sup>6</sup> The Manchester, CT, Lead Abatement Project was involved throughout the design and implementation phases of the Connecticut DPH

training project. The Yale Lead Program was involved in the design and evaluation components of the project.

The present study sought to measure in the near- and long-term whether trainees would learn and retain general information about lead exposure; develop and retain positive attitudes toward lead-safe work practices; and develop positive behavioral intentions to use lead-safe work practice skills and techniques.

## METHODS

### Research questions

To assess the impact of the training project, a formal evaluation process was developed. Although there was no feasible way to observe the actual work practices of participants before and after the program, we decided that understanding change in more readily measurable characteristics could provide useful information about the impact of the training. The focus on "behavioral intentions" was necessary because not all participants had opportunities to practice the skills and techniques addressed. Instead, participants were asked to report not only the behaviors they believe they actually used, but also those they would use given the opportunity.

The study questions were: (1) Does lead-safe renovation training make a difference in participants' knowledge about lead exposure, their attitudes about lead-safe practices in lead work areas, and their behavioral intentions related to protective and preventive work measures after the training? and (2) Do knowledge, attitudes, and changes in behavioral intentions last over an extended period of time after the training?

### Participants

The target audience for the Lead-Safe Work Practices Training Project was home improvement contractors and their employees (including renovators, remodelers, and painters) and small property owners in several cities and towns in Connecticut. Training sessions were held in Manchester, Hartford, and Waterbury. Recruitment took place through various organizations and associations such as the Urban League of Hartford, the Antiquarian Society, property owners associations, and the Office of the Housing Court Prosecutor in the Hartford area. Participants were invited to attend the training program free of charge with the request that they complete a short questionnaire before and after the training and once more several months following the training. Completion of the questionnaires was considered consent to be included in the program evaluation study.

### Curriculum

The training course was based on a curriculum developed by the National Environmental Training Association (NETA) for lead-based paint maintenance,<sup>6</sup> with revisions to better meet the needs of renovators and remodelers. The course was eight hours in length, presented as either two four-hour evening sessions or one eight-hour weekend session. The course was presented by an experienced trainer and licensed lead consultant contractor in the state of Connecticut who was also a rental property owner. Teaching methods included oral and visual presentations, discussions, and hands-on practice.

### Measurement tools

A program evaluation questionnaire was developed based on theories of health beliefs and health behaviors, as well as questionnaires that had been used in similar projects.<sup>7-12</sup> The questionnaire was designed to measure aspects of the participants' knowledge of lead poisoning; their attitudes toward lead-safe work methods and lead abatement techniques; and reported or intended behaviors related to protective and preventive lead-safe work measures for working with lead-based paint.

To develop the project questionnaire, we reviewed the curriculum used in the NETA training program for content. A list of relevant content areas was generated and reviewed by representatives from the child health, public health, and professional renovation fields. These content areas included lead-based paint hazards; health effects and long-term risks of exposure to lead, especially for children; lead-safe work practices; protection of oneself and others when working with lead-based paint; and equipment and materials that could be used to work in a lead-safe manner. A preliminary list of questions was generated based on these areas.

A preliminary questionnaire was developed containing 32 items: 18 knowledge questions, 8 attitude questions, and 6 behavior questions. Representatives from the areas of medical care, public health, lead poisoning outreach, rental property ownership, skills training, and renovation reviewed this questionnaire. Subsequently, the questionnaire was tested on a small group of attendees at a lead-safe work practices training workshop. Based on feedback from the trainer and results from the preliminary questionnaire, the tool was shortened and simplified. The final questionnaire contained 20 total items: 10 knowledge questions, 5 attitude questions, and 5 behavior questions (see Figure). To provide consistency from session to session, specific directions for administering the questionnaire were also developed.

The questionnaire was used at three stages. First, it was used to gather pre-training, baseline information about the participants' knowledge, attitudes, and pre-training behavior. Next, it was used to gather post-training data about knowledge, attitudes, and behavioral intentions. Finally, it was used to collect information in each of the three areas following a time lapse of three to six months after training.

### Data collection

Questionnaires were completed at the beginning and end of each training workshop. Three months after training, each participant was mailed a questionnaire (with a stamped return envelope) to complete and return for long-term follow-up. Those who did not return the questionnaire by mail were contacted by telephone and reminded to do so. Additional questionnaires were sent when necessary, and up to three calls were made before the participant was accepted as lost to follow-up. Those participants who attended only one session of the split-session workshops were also considered lost to follow-up.

The trainer and other project members held discussions to share anecdotal observations made during the workshop sessions. Because these observations may be important to others attempting similar training projects, they are described in the Results discussion.

### Data analysis

Coded data from the questionnaires were sent to the evaluation team at the University of Connecticut, where SPSS software was used to analyze the data.<sup>13</sup> Changes in knowledge, attitude, and behavior scores were analyzed using dependent *t*-tests.

## RESULTS

During a six-month period, nine training courses were conducted, with a total of approximately 150 participants registered for training. Pre- and post-training questionnaires were received from 116 participants. Sixty-seven (58%) of these 116 participants returned the long-term follow-up questionnaires during the subsequent three- to six-month period. Only questionnaires with responses to all questions in a given component area (i.e., knowledge, attitude, and behavior) were utilized for analysis of that particular component area.

Of the 116 participants who submitted pre- and post-training questionnaires, 97 also responded to the demographic questions ( $n=97$ ; 84%). Of the 97 respondents to the demographic questions, 70 were males (72%). Respondents to the demographic questions had a mean and median age of 51 years (range 20–75 years). Twenty percent of respondents to the demographic questions had children younger than age 6, more than half ( $n=53$ ; 54%) were property owners, and about 14% ( $n=14$ ) indicated their interest in property renovation.

All three broad characteristics showed statistically significant changes from pre- to post-training (Table 1). Knowledge improved, and attitudes and behavioral intentions changed in a favorable direction.

The responses remained stable from the time of the post-test to that of long-term follow-up three to six months later, for those who returned the follow-up questionnaires (Table 2). Knowledge did not change significantly, indicating retention of the learned information. Attitudes toward protective lead-safe work methods and preventive abatement techniques remained favorable, as did behaviors related to protective and preventive work measures. Thus, the beneficial impact of the training program seems to have endured over time.

The internal consistency of the knowledge, attitude, and behavior components of the questionnaire varied, ranging from weak to strong. The knowledge component had the smallest Cronbach's alpha coefficient at  $\alpha=0.41$ . Although this is weak, item scores indicated that participants acquired information between pre-training and post-training, indicating that a desired outcome of the tool had been achieved. For the attitude portion,  $\alpha=0.74$ , indicating reasonable internal consistency. The reliability coefficient for the behavior component was  $\alpha=0.85$ , suggesting strong internal consistency. There is enough evidence to suggest that, in general, the questionnaire has at least moderate internal reliability, the knowledge portion being the weakest. Other types of reliability have not been evaluated.

### Anecdotal observations

The discussions during the training sessions were useful and revealed the participants' concerns. Some of these discussions

### Figure. Pre-training lead-safe worker training questionnaire

This questionnaire is NOT a test. It is to help us determine the effectiveness of the training sessions and pinpoint areas of the curriculum which need modification. It is important that we know your honest opinions and answers. Thank you for completing it.

**Please check ALL of the ways you think children can get lead poisoning.**

1. \_\_\_\_ from breathing lead fumes from cars now in use in the United States
2. \_\_\_\_ from drinking the tap water in most homes
3. \_\_\_\_ from picking up and eating small particles of lead paint they find
4. \_\_\_\_ from putting lead dust coated toys and fingers in their mouths
5. \_\_\_\_ from absorbing lead dust through their skin when playing in areas near lead paint
6. \_\_\_\_ from breathing in lead dust created during sanding of lead paint
7. \_\_\_\_ from breathing in lead fumes when lead paint is being burned off
8. \_\_\_\_ from dust on parents' clothing if they work with lead paint or do renovation involving lead paint
9. \_\_\_\_ from intact paint that contains lead
10. Circle only one: The most common way children get lead poisoning is by...
  - a. Eating paint chips
  - b. Breathing dust or fumes
  - c. Hand to mouth activity (putting hands and toys in mouth)

**What is your honest opinion about the importance of the activity described? Circle only one.**

- |  |                      |                            |                             |                       |
|--|----------------------|----------------------------|-----------------------------|-----------------------|
| 1. Avoiding eating and drinking on a job where lead dust is generated is   | <i>Not important</i> | <i>Minimally important</i> | <i>Moderately important</i> | <i>Very important</i> |
| 2. Unless otherwise known, assuming that paint in a home built before 1978 contains lead is...   | <i>Not important</i> | <i>Minimally important</i> | <i>Moderately important</i> | <i>Very important</i> |
| 3. Assuring that children and pregnant women are out of the house anytime work will generate lead dust or fumes is...                      | <i>Not important</i> | <i>Minimally important</i> | <i>Moderately important</i> | <i>Very important</i> |
| 4. When you go home, making sure your skin, hair, and clothes are free of dust that may contain lead before hugging your children is...    | <i>Not important</i> | <i>Minimally important</i> | <i>Moderately important</i> | <i>Very important</i> |
| 5. Isolating work areas where there may be lead-based paint from the rest of the house by using 6 mil plastic sheeting and duct tape is... | <i>Not important</i> | <i>Minimally important</i> | <i>Moderately important</i> | <i>Very important</i> |

**Circle the choice which best describes what you presently do when you have a job that may involve lead paint. Circle only one.**

- |  |                       |                        |                 |                         |
|--|-----------------------|------------------------|-----------------|-------------------------|
| 1. Wash my hands frequently when on a job that may involve lead paint.   | <i>Hardly ever do</i> | <i>Occasionally do</i> | <i>Often do</i> | <i>Nearly always do</i> |
| 2. Use a wet clean-up technique on the site at the end of a job that may involve lead paint.                         | <i>Hardly ever do</i> | <i>Occasionally do</i> | <i>Often do</i> | <i>Nearly always do</i> |
| 3. Unless otherwise known, assume any home built before 1978 contains lead.  | <i>Hardly ever do</i> | <i>Occasionally do</i> | <i>Often do</i> | <i>Nearly always do</i> |
| 4. Warn the people living in a house when work must be done which might generate lead dust.                          | <i>Hardly ever do</i> | <i>Occasionally do</i> | <i>Often do</i> | <i>Nearly always do</i> |
| 5. Use a wet, rather than dry, sanding or scraping technique when working with areas of paint that may contain lead. | <i>Hardly ever do</i> | <i>Occasionally do</i> | <i>Often do</i> | <i>Nearly always do</i> |

involved questions about federal lead disclosure requirements for landlords and property managers and the federal requirement to distribute lead information to owners and occupants before proceeding with renovations in pre-1978 homes.

The trainer reported the following observations: audiences responded best to a pragmatic practical message; a learner-centered approach seemed to work well; and an

emphasis on the cost benefit of lead-safe work practices over standard work practices was useful (for example, the trainer suggested that advantages such as easier clean-up and less risk to occupants were worth the added cost of using lead-safe work methods). Also of importance to trainees were responses to specific questions such as: What does the law mandate that a worker must do? What makes sense in my work context? What provides optimum protection for home

**Table 1. Changes from pre-training to post-training**

	n	Mean difference	SD	t	df	p-value
Knowledge	114	-1.39	1.91	-7.76	113	<0.0001
Attitudes	107	-0.68	2.63	2.68	106	<0.008
Behaviors	100	-3.45	3.90	-8.84	99	<0.0001

SD = standard deviation

df = degrees of freedom

occupants and workers? Because of the wide range of expertise of the participants, from novice homeowner to skilled craftsperson, the hands-on component of the program was sometimes difficult. Some trainees felt this part was too simple, while others thought it was too complex. Thus it would be ideal to focus specific training sessions on individuals with similar backgrounds and skill levels.

Many participants were interested in how children become lead-poisoned, and there was a surprising amount of misinformation within the group. When provided with a factual account of the lead exposure process, most trainees appeared willing to change work practices to prevent this occurrence.

Partnership with a local organization created the best recruitment environment. Participants who had received an order to abate a property or who were members of a sponsoring organization usually stayed to the end of training. There was some suspicion and reluctance from the participants about completing the demographic surveys and questionnaires. Nevertheless, a substantial number of participants responded.

In general, the training increased awareness of Connecticut's public health approach to addressing lead issues. Trainees who were property owners reported anecdotally that the training had increased their confidence in dealing with lead issues during renovation, remodeling, or maintenance activities at their residential properties.

## DISCUSSION

This small pilot study reveals the success of a program that teaches those who may disturb lead-based paint during renovation, painting, or maintenance activities how to use lead-safe work methods that protect occupants and workers from lead exposure. There was evidence that workers were motivated to protect the health of children once they understood methods that could be used to do so, especially when they developed an understanding of the cost benefit of such methods.

## Limitations

This pilot study had several limitations. The study group was not randomly selected, the number of respondents was small, and there was no control group, limiting the generalizability of the results. A number of the participants chose not to complete all evaluation questionnaires. This group may have differed from the group that completed all questionnaires; there was no way to determine this. In addition, intention for behavior change was self-reported and not confirmed through work site observation. And, as with all self-reported data, a bias toward social expectations may have existed.

## Implications

Properly designed and marketed lead-safe training courses can have a positive impact on knowledge levels, attitudes, and behavioral intentions of workers who will disturb lead-based paint during their day-to-day renovation, painting, or maintenance activities. These benefits can also extend to property owners who perform such activities.

In addition to reducing lead exposure and primary prevention of lead poisoning, the cost benefit potential of modifying work practices to incorporate lead-safe techniques was of particular importance to many trainees. Cost considerations should be a component of any such training endeavor. Regulatory motivation is also a factor when laws exist that require such training or mandate compliance with methods and procedures that are taught during the training.

To the extent that it is practical, grouping trainees with similar needs and expertise or skill levels could be advantageous for similar training initiatives, and particularly for the hands-on training components. A training curriculum should be sufficiently flexible to permit trainers to focus training on the specific needs of sub-groups of trainees.

The use of lead-safe work practices during renovation, painting, and maintenance activities contributes to primary prevention of lead poisoning by reducing lead-based paint hazards and minimizing the inadvertent creation of new lead hazards. This is particularly important because lead-based paint is the primary remaining source of childhood

**Table 2. Changes from immediately post-training to 3–6 months post-training**

	n	Mean difference	SD	t	df	p-value
Knowledge	68	0.29	1.91	1.27	67	>0.20
Attitudes	61	-0.18	0.81	-1.75	60	0.09
Behaviors	64	0.27	1.46	1.45	63	>0.15

SD = standard deviation

df = degrees of freedom

lead exposure in the U.S. Skills development in those who work at projects or jobs where lead-based paint might be disturbed is an essential ingredient of this prevention process. This pilot training project suggests that skills training can be successfully developed and implemented. Evaluation of the project indicates that such training can create lasting changes in the knowledge, attitudes, and behaviors of workers.

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