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Challenges in Residential Fall Prevention: Insight From Apprentice Carpenters

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Background *Falls remain a serious source of morbidity and mortality in residential construction despite considerable knowledge of risk factors and prevention strategies. While training is universally viewed as positive, we know little about its effectiveness in preventing residential falls.*

Methods *A series of focus groups were conducted with union apprentice carpenters (n = 36) at varied levels of training to elicit input on factors that might influence the effectiveness of residential fall prevention training, including hazard awareness, timing of elements of formal instruction, jobsite mentoring, and workplace norms.*

Results *While apprentices identified many residential fall hazards, they voiced little concern about work near unprotected vertical or horizontal openings such as stairwells, window openings or leading edges. On residential jobs, apprentices worked at heights immediately and were often exposed to hazards they had not yet been trained to handle. The quality of mentoring varied tremendously, and things they had been taught in school were often not the norm on these small worksites. Use of fall arrest equipment was uncommon. Job insecurity in this fast-paced work environment influenced behaviors even when apprentices reported knowledge of safe procedures; this was more of a problem for less experienced apprentices.*

Conclusions *These data provide compelling evidence that apprentices often do not apply safety principles they have been taught in school in the actual work environment, illuminating how attempts to empower workers through training alone can fall short. The findings have policy implications and demonstrate the importance of measuring more than knowledge when evaluating effectiveness of training.* Am. J. Ind. Med. 51:60–68, 2008.

KEY WORDS: occupational injury; falls; fall prevention; carpenters; residential construction; focus groups

INTRODUCTION

Significant morbidity and mortality from occupational falls are well documented in the construction trades [Sorock et al., 1993; Kisner and Fosbroke, 1994; Leamon and Murphy, 1995; Cattledge et al., 1996; Ore and Stout, 1996; Ringen and Stafford, 1996; Courtney et al., 2002; Lipscomb et al., 2003b,c]. These injuries are not just a

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public health problem of commercial construction workers but also a significant problem in residential construction [Dement and Lipscomb, 1999; Shah et al., 2003; Lipscomb et al., 2003a,d]. Falls are the leading cause of workplace fatalities in residential construction; while the total number of construction deaths decreased in 2005, the most recent year for which national data are available, the number of fatalities increased in residential construction [U.S. Department of Labor Bureau of Labor Statistics, 2006].

In the U.S., apprenticeships are an important part of the unionized construction industry. Apprenticeship programs are accredited by the Bureau of Apprenticeship and Training, Employment and Training Administration, U.S. Department of Labor, and they must conform to certain required standards. Among these are provisions for formal classroom instruction and on-the-job training under the mentorship of journeymen carpenters during the proscribed three to 4-year training [U.S. Department of Labor, 2007]. Both aspects of the training are viewed as necessary to provide basic knowledge and craft skills, as well as the recognition and management of safety hazards at the work place for both routine and non-routine tasks. Although there are topics that must be covered during the formal instruction, the methods of delivery and proficiency testing vary among programs.

Although apprenticeship programs are at the core of construction skills and knowledge training, we know very little about the applicability of the current fall prevention training to the work site and this may be particularly true in residential carpentry. There are relatively few areas of the U.S. with a large proportion of union workers in the residential workforce. Therefore, it is not known whether existing union apprenticeship programs, developed in large part around commercial construction, adequately train apprentices for the hazards of residential construction, including work at heights. We also do not know whether some aspects of apprenticeship training are more effective than others (classroom, hands-on with supervision, on-site mentoring).

We report on data collected through a series of focus groups designed to elicit input on fall prevention from apprentice carpenters at different levels of their training. These groups were conducted as part of a needs assessment of the residential construction fall prevention curriculum at a large carpenter apprenticeship program [Evanoff et al., 2006]. We were specifically interested in the views of relatively inexperienced workers on factors that might influence the effectiveness of such training. Of particular interest were the timing of key elements of training, barriers to the use of fall prevention measures, and the apprentices' recommendations for improvements.

METHODS

Setting and Recruitment of Participants

This work was done through partnership with the Carpenters Joint Apprenticeship Training Program (CJAP) in St. Louis, Missouri. This 4-year program has 2,400 actively enrolled apprentice carpenters who return approximately every 6 months for 2 weeks of instruction at the training center. The joint labor-management program is supported by The Carpenters District Council (CDC) of Greater St. Louis and Vicinity and by contractors hiring union carpenters in the area. The CDC represents 80–90% of the residential carpenter workforce in the greater St. Louis metropolitan area, the largest unionized residential workforce in a single geographic area in the country.

We recruited focus group participants from apprentices taking classes at CJAP. We did not attempt to recruit in a random fashion, but specifically asked for participants who were willing to share their experiences. The groups were held at the end of a school day in the apprenticeship school for convenience. Refreshments were served, and participants received a $20 gift card to a local grocery store for participating.

Conduct of Groups

Because apprentice carpenters spend only 2 weeks each 6 months in school and the remainder of their time in the field, we were interested in how the timing of their training prepared them for the work they were assigned. We were also interested in recommendations they would make for improving their training experiences, and barriers to use of fall prevention practices on residential sites. In preparation for the groups, we developed an outline of broad categories of information we were interested in collecting from the apprentices. These topics were based on existing published literature, prior information on falls that arose in focus groups exploring general safety issues among union carpenters [Lipscomb et al., 2003d], and input from the apprenticeship trainers. A focus group guide was then developed in several iterations. The final guide included both broad questions and more detailed probes that could be used to elicit information if needed. Information was sought within four broad domains: (1) fall hazard identification, (2) training in school, (3) training on worksites, and (4) worksite practices. Questions related to fall prevention training and skills training were both asked. This semi-structured tool was a guide, not a questionnaire, and we allowed the group members to discuss topics in the order they were raised.

This type of approach has been termed "prestructured case" by Miles and Huberman [1994]. Unlike a grounded theory approach, where the aim is to develop and then test theories from the data, the prestructured case is used when researchers have a conceptual framework, the questions are reasonably well defined, and the sampling plan is established.

After informed consent, each group was audio-taped. Names were not used throughout the process. All procedures for the conduct and analyses of these groups were approved by Institutional Review Boards at Washington University and Duke University Medical Center.

Analyses

Transcripts of the focus groups were reviewed and imported into QSR N6 software for analyses [QSR, 2000]. An initial coding structure, based on the broad domains from the focus group guide, allowed us to organize information on hazard identification and exposures, training and work practices. A content analysis approach was used to assign codes to passages of the focus groups [Patton, 2002; Ulin et al., 2005]. Although the guide provided the basic structure, we also identified other issues, or themes, which provided insights and challenges for training; these were also coded as the transcripts were reviewed.

RESULTS

Five focus groups were conducted with 5–10 (total = 36) participants in each, resulting in 6,622 lines of transcribed text and notes of the moderators. Apprentices in their first term of training attended after 4–6 months in the field; they were in a group alone. In subsequent groups, terms 2–4 (1–2 years of training) were together, as were terms 5–6 and 7–8 (2–4 years of training). Two groups were conducted with the latter more experienced apprentices in the final year of their apprenticeship.

Fall Hazard Awareness

When asked to talk about tasks or activities that placed them at risk for a fall from height, apprentices in each group immediately identified setting trusses. This included concerns about work done on the top plate of a framed wall, receiving trusses from a crane, placing piggybacks, and ‘‘riding the ridge.’’ [Note: To aid the reader, specific construction terms are defined in the accompanying appendix.]

A wide variety of other hazards were consistently reported in the groups including roof sheathing, ladder work, setting second floor joists, setting windows, plating foundations, soffit work, and hanging drywall off ‘‘stretch boards.’’ The apprentices described danger associated with the use of ladder jacks and they felt pump jacks were easier to use and placed them at less risk. Concerns surrounding the ladder jacks included re-setting the pic boards as the work moves higher, accomplished by mounting and dismounting from the pic board to one of the support ladders without access to a third ladder as proscribed.

> ‘‘You’re trying to move your pic up after you’ve reached from the pic board and nailed as high as you can. You’ve got to climb over the edge of the pic board and stand on a ladder, hold the pic board on your shoulder, and maneuver the jack up another rung, or two or three rungs, while you’re standing on the ladder. It eliminates your three points of contact a lot of times. Technically you’re supposed to set up another extension ladder beside the pick board, so you can get on and off, but nobody does it.’’
> ‘‘No, no one does. Half the time your crews don’t have three extension ladders to be able to do that.’’

These apprentices also described dangers from traps created in the building process such as floor joists that are placed but unsecured and weather conditions that placed them at greater risk such as wind, rain, snow, frost and mud. They did not mention hazards from unprotected openings (vertical or horizontal) or work on unprotected edges when asked about hazards.

Fall Hazard Exposures

Much of residential construction work is at elevations and so it is not surprising that apprentices reported working at heights very early in their careers; for many it was immediate. Exactly when apprentices began to do the ‘‘dangerous tasks’’ related to fall hazards was dependent upon who they were working for, including the size of the contractor, and ‘‘attitudes toward cubs.’’ Some who worked for larger contractors described hauling materials as the initial primary task, but most reported working at heights right away on ladders, scaffolding and roofs. Some apprentices described the assignment of dangerous work or ‘‘bad jobs’’ to apprentices, explaining that journeymen ‘‘keep their feet on the floor.’’ It was clear that for some apprentices to get on the top plate of a framed wall or ‘‘ride the ridge’’ when trusses are set was a rite of passage.

> ‘‘Or when you’re setting trusses, the two higher guys are on the walls, because you got to set the truss exactly right to get them all to line up, so the low-term guy has to walk the ridge and put the piggybacks on those peaks at the top. I was doing that because, ‘‘You’re low-term, get up there.’’ They kind of give you the jobs that you can’t mess up, but they can also be some of the more dangerous jobs. They do it to break you.’’

> “If you can’t get over it [fear], you’re not going to be able to do this job.”

Behavior on Work Sites

Some apprentices reported positive safety practices where others discussed inconsistent or infrequent application of safe practices. Safety practices reflected policies of the contractors as well as the behaviors of the journeymen with whom they work. Some contractors obviously have policies that are enforced regarding fall prevention, but there was variety across sites of the same contractor.

> “We’ve got a good crew. Everybody knows what they’re doing. So, pretty much when we get done putting the second floor subfloor up and the walls, the railings are already there. We got four guys who know what they are doing. Some crews in our neighborhood don’t do the stuff we do. We take a little more time, but also, we walk away and go home safe, too.”

Although these apprentices reported some use of fall arrest equipment by carpenters installing exterior siding, use of fall arrest equipment was uncommon on the residential sites where these apprentices worked. They accurately described situations where fall arrest equipment should not be used; for example, when the structure is not adequate to handle the load. Some clearly believed it was more dangerous to use fall arrest equipment than not, while others felt they should be using it but they had never seen the equipment on site.

And as one said:

> “Never seeing something (safety equipment) makes me feel it is not offered.”

Some later term apprentices explained further that there were times when your residential company will have their own safety programs designed to address situations in which OSHA guidelines do not work, and the importance of knowing your own company’s program for these situations.

> “The OSHA regulations are not practical in [some] applications, so therefore this is how we want our people to be.”

Some of the more experienced apprentices reported improvements in work safety practices they have seen over time, but acknowledge that many journeymen do not practice what the apprentices are taught at school and this influences the apprentices’ behaviors.

> “Pretty much everything they talked about in training (at school) after six months, “this is how it should be done,” and you’re like, “that ain’t the way we’re doing it out in the field”.”

Mentoring that apprentices received on site is highly variable. Some report working with journeymen who teach them and are concerned for their safety and skill.

> “A lot depends on your journeyman, like we said before. A lot of times they’ll tell you, “Don’t do that.” Its like, sometimes they’ll walk by and they’ll see somebody with their ladder leaning, and they’ll say, “you need to open that ladder up.” But not only equipment, but building practices. “Hey, don’t walk on that,” or “First, before you walk on that, let’s nail this brace off.” Or, “Get handrails for that.” That’s their job, to keep us safe.”
>
> “My crew has never had an accident, so they basically like watch you every minute to make sure you do it safe, because they’ve never had an accident.”

Others felt devalued by the journeymen with whom they worked. They believed they were assigned the more dangerous and taxing work and they get the message, “don’t ask for instruction on site.” Some felt they got more mentoring from higher level apprentices on the site.

> “Yeah, you can learn more from an apprentice than a journeyman any day of the week. They [journeymen] don’t even want to talk to you because you’re just nobody to them. Another apprentice is going to be like, he’s going to help me out if I’m not knowing anything. So, of course, it’s going to be the apprentice, because that’s who I’m going working with all the time. The apprentice is going through the same thing you are. You’ve got a couple of apprentices that are already a level or two ahead of you, they’ll take time to teach you what they know.”

Assumptions were made by journeymen that apprentices knew how to do things that they did not know how to do and that they may, in fact, have had no exposure to at all. Setting ladders was one example. Training sometimes only occurred after an accident. For example, journeymen sometimes assumed a “cub” knew how to use a ladder; but after it slipped out from under him, the journeyman provided training in how he should have done it. More experienced apprentices reported:

> “if your work ethic is good, journeymen will show you how to do things, but you have to show them first that you will show up and work hard.”

Apprentices report that they cannot tell journeyman that they won't do something even if they felt it was unsafe. This was especially true among the lower level apprentices. Among the more experienced apprentices, there were reports of a number of assertive behaviors—refusal to do certain things or comfort in choosing to do things in a manner different from the journeymen on site. Although still a concern for them, they seemed to be less fearful that standing up for their own safety would get them fired. An upper term apprentice explained,

> ''My first couple of years I kept my mouth shut. Now I can say stuff, because I've been doing it for a while, so I can voice my opinion. I know that I have job security. But when you're a ''cub'' you don't have job security because you're a dime a dozen. Now I can say, ''Hey, look, we need to do this a little bit better.'' But back then, there's no way, because they'll fire you and go hire the next person. So start voicing your opinion about getting that little harness, stuff on the side, they'll be like ''We can get another person to come right out here tomorrow, get paid the same price you get paid.'' I got a couple years in now, so it's different.''

Some of the discussion of the apprentices demonstrated great value in having a crew you worked with regularly. They described valuing and watching out for each other, and they contrasted their teamwork to working with the crane operators who are not part of the regular work team. They felt that the crane operators did not necessarily watch out for those receiving the trusses.

> ''setting the trusses with crane operators. Some of them, man, they swing them in there hard and fast! If you're not paying attention, they'll knock you right off the wall. It's happened before.''

Training

The apprentices in these groups were not naïve; they recognized some of the challenges in their school-based apprenticeship training. They felt that they needed to know a lot to be safe and competent before they ever went on work sites, and they recognized it was not possible to teach it all at the beginning of their training. They recognized that some union apprentices had experience in the trade and others were completely green, making it more challenging to make the instruction relevant for all. They knew many of their classmates dropped out of the program early and that investing a lot in very early training may be wasteful. However, they also believed some of the attrition would be reduced with more training early, so that apprentices were able to function more comfortably on work sites.

They also understood that it is not easy to convey risk messages to workers, experienced or otherwise.

> ''I think the biggest way people learn fall prevention is – and I hate to say it – by seeing someone do it [fall]. It makes you think watching somebody take a fall. When somebody falls, or even when you hear about somebody you work with, it makes you think. Makes people more careful.''

They strongly described learning best with hands-on experiences, and they know it cannot all be delivered in school. Setting trusses with a crane was one example they cited. While principles could be taught, they recognized that the physical resources were not available to practice this skill at the school.

They clearly believed that ''safety is first'' at the school. They consistently received the message from all the instructors at the school that safety matters—that you should come home everyday and that sometimes you have to tell people you won't do something. The instructors offered suggestions to help them deal with difficult situations; they were told to call the union business agent representing them, to use the union safety hotline, and not to worry about being labeled ''a snitch.'' There was clearly no mixed message from the school, and the apprentices respected this consistency.

However, the apprentices reported that the things they are taught to do in school to prevent falls are not done consistently on work sites. They also reported some practices related to organized on-the-job training that gave them mixed messages about safety. For example, they perceived that some of the toolbox talks were not designed to provide them with meaningful safety information. When the safety person presenting the material prefaced their presentations with ''I know you don't do it this way,'' it gave the apprentices the message that there was no expectation that the work was really going to be done in the safer manner being presented. Similarly, training was devalued when the material was quickly presented with an emphasis on their signing a form that they were present, conveying to the apprentices that the training was ''only for show.''

Challenges in Field

The feeling was pervasive across all levels of training that in residential construction ''time is money,'' and the fast-paced nature of the work influenced safety decisions. They believe this is more so in residential than in commercial construction. Apprentices reported that they just have to ''deal with it'' if they did not have appropriate equipment because there was not time to wait.

> "I got a time limit to meet, and if I don't make it, then it's my butt."
> "The problem you actually run into on the journeymen thinking safe is time. Time."
> "Speed is a killer."
> "A lot of contractors don't let you use toe boards at all. They say it takes too much time."
> "I think OSHA should step in on the time part. Because if we don't meet time—if we meet time, we're unsafe, a hundred percent unsafe."

For many apprentices this was compounded by concerns about job security. There were numerous examples of apprentices' worry that they would be let go influencing their safety behavior and practices. Concerns about job security did not seem to be unfounded; the apprentices provided personal examples of being laid off for refusing to do a dangerous task. They reported employers using different reasons for letting someone go as well, but they believed lay-offs occurred for trying to be safe when that was not the norm or when it would slow down the work.

> "I told him (foreman), "I ain't getting up there," and he says, "Well, fine, go home. You're laid off. So I walked off, called back to see where I was going the next day. They said "Well, you're laid off."
> "I mean they can't make you do anything. They can stop you from working though. They say, "Oh, now I don't have any work for you, so I'll give you a call in a couple of weeks."

For some of these apprentices the take home message from on-site training and experience was clearly that you have to be willing to take risk. There were other examples where this was not the case and apprentices reported that they could call for materials or equipment that they needed, and had even been encouraged to do so. These men still recognized the fast-paced work, but reported "you always can do something else" to keep the work moving forward.

> "They [the contractor] gave us cards of people that we can call that work for the company, that if you have an unsafe situation call them and they will get whatever you need [something] right away, out to the jobsite."

Time pressures were sometimes compounded by bonuses offered by contractors for finishing framing in a set number of hours or incentives for not having injuries. Unfortunately, the apprentices reported that these made things more difficult for them.

> "You get yelled at by your foreman to work faster—if we got under hours [proscribed number], we'd get a bonus on our check at the end of the year. That was pressure."
> "Yeah, if the company goes a quarter without any lost-time accidents, there's four or five hundred dollar cash drawings."

When asked if this would discourage anyone from reporting an injury, the response was:

> "Well, at my job, you can get hurt—so long as it's not turned in, it's not an actual reported injury."

The apprentices described challenges in keeping up with new materials and building needs. They described the wider expanses in residential homes, high loft ceilings, and walkout basements that increase fall hazards in residential building. The use of newer material, such as hardy plank instead of lighter-weight siding and 16-foot sheets of drywall, were felt to increase fall hazards, from work on scaffolds or pic boards, due to excess weight.

Recommendations for Training

While the carpenter apprentices seemed to agree on a number of recommendations for improving content areas of their training (Table I), they had conflicting opinions about training in use of fall arrest equipment; some felt this should remain in their curriculum while others felt it was a waste of time since it was so rarely used in residential carpentry.

TABLE I. Recommendations of Union Apprentice Carpenters Relevant to Fall Prevention Training in Residential Construction

- Teach setting up walk boards and handrails, including appropriate heights, early
- Residential carpenters need scaffold training that is applicable to residential construction—platform scaffolds (Bakers type), brick masons' scaffolds, pic boards and ladder jacks, and pump jacks
- Scaffold training needs to address set up, assembly, dismantling and work practices
- Ladder training should include practice setting and staking ladders, including on uneven terrain. Getting on and off different slope roofs should be practiced
- Work on mock-up roofs of varied slopes (such as 10′-12′, 12′-12′, 16′-12′).
- Practice placing and removing toe-boards on different sloped roofs
- Training to set first trusses from step ladders inside framed walls must be in field to adequately address challenges faced including receiving materials from a crane

Two recommendations crossed all topic areas consistently. First, they very clearly articulated their preferences for demonstration and hands-on training. For example, they asked that they not be told what angle to set a ladder at, but rather shown. They did not like classroom training and ''pencil-and-paper tests,'' and they found their 2-week periods in the classroom especially difficult after having time in the field.

> ''We're carpenters – if I wanted to do that or was good at that I would have gone to medical school.''

Second, they had strong preferences for reality-based training. They wanted to be prepared for what really happens in the field and that included ''if you don't move fast you are gone.'' They related the experience of an apprentice who marked where he would nail on a framing job and was ridiculed. Some school training was equated with more precise cabinet making, as one commented:

> ''Framing is not like that—you can't mark where nails are going to go—you have to move fast.''

They also liked it when their instructors provided real-life stories to demonstrate points about safety, and they learned from ''examples, not regulations''.

DISCUSSION

Residential carpenters work from a variety of elevated surfaces: surveillance data indicate that they fall from all of them [Dement and Lipscomb, 1999; Lipscomb et al., 2003d]. These events involve falling off or through work surfaces as well as surfaces that collapse or fall. Some work surfaces are likely more dangerous than others because the severity of injury sustained may be greater from some work surfaces or because the exposure leading to the fall is more precarious. However, it is difficult to measure risk precisely in construction because of lack of information documenting exposure time to individual hazards.

The apprentices we talked with identified many recognized fall hazards including the three sources that account for the majority of residential falls, namely work on roofs, ladders and scaffolds [Dement and Lipscomb, 1999; Lipscomb et al., 2003d]. In contrast, they did not mention concern about other documented hazards such as work near unprotected vertical or horizontal openings/edges including open stairwells, window openings, or unprotected leading edges. Some tasks, such as setting trusses, are responsible for relatively little exposure time and they do not result in a great number of falls. However, they may be particularly dangerous, explaining why these apprentices were very quick to articulate risk associated with this task.

Even among union apprentices enrolled in a structured training program, exposure to work at heights was immediate for most, and they rarely received instruction in tasks they were expected to do or in fall protection before they were first exposed. The mentoring reported on their worksites varied tremendously, from tutelage and demonstrations that the apprentices found very useful to dangerous practices of letting someone learn, literally, by the school of hard knocks. It is not surprising that these craft workers view hands-on training as most useful [Orr et al., 1999]. Unfortunately, some of the hands-on in regard to fall prevention in the field involved being taught the wrong way.

Speed of work in residential carpentry was significant for these apprentices, both creating stress and influencing their decision-making about safety behaviors. With absolute consistency, these apprentices reported that the training school instructors emphasized the importance of their appropriately asserting themselves to protect their own safety. However, they clearly had difficulty doing this and they let concerns about job security influence safety practices.

The apprentices volunteered enlightening information about incentives offered for speed and safety. Apprentices found these incentives placed added pressure to work rapidly in an already fast-paced work environment and to under-report injuries. The effects of incentives are difficult to evaluate systematically, but researchers have reported that while construction workers report preferences for material incentives for safety behaviors designed to prevent falls, they actually responded more favorably over a 6-month period to non-material incentives [Winn et al., 2004].

Our findings were remarkably consistent across different levels of training. The apprentices reported many good practices on residential sites, and we do not want to give the impression otherwise. Some apprentices reported having equipment they need, mentoring from crew that cared about them, journeymen who used best practices, useful on-site training and hazard awareness, as well as a commitment to safety first. However, this was not the norm.

The definitions of safety culture and safety climate remain a source of controversy [Guldenmund, 2000]. However, regardless of semantics or precise conceptual frameworks, many of the concerns/desires voiced by these apprentices are consistent with principles that others have described as key for an environment that fosters workplace safety [Hale, 2000].

These include:

- a commitment to safety as a process that starts at the top,
- the sanctioning and rewarding of safe behaviors even if they cost time, money, and resources,
- resources to manage risk (people, equipment, procedures) including assurance of competence of people for required responsibilities, and

- ‘‘caring trust’’ among parties that each will do their work, but ‘‘that each needs a watchful eye and helping hand to cope with the inevitable slips and blunders which can always be made’’ [Hale, 2000].

We recognize there are limitations to this work. Our work was conducted in a union apprenticeship school where the vast majority of apprentices were white males. Some of the specific recommendations and insight into training, particularly, are directly relevant to this particular population. Most homebuilding in the U.S. is done in the non-union sector, and there is a growing immigrant face on residential construction throughout much of the nation which includes many non-English speakers.

Despite these limitations we believe that much of the information is more widely applicable for a number of reasons. Many aspects of residential construction sites are the same everywhere; they are typically small, fast-paced environments. There are no permanent job sites, as in an industrial setting, in which to place environmental controls or to easily regulate or reinforce safety practices. As the house is constructed, the environment and the associated safety hazards change. The building challenges the apprentices described reflect changes in homebuilding design and materials, and they are not unique to the St. Louis area. In addition, the training model for most trades, whether unionized and not, involves less experienced workers operating under the supervision of more skilled craftsmen.

We suspect, if anything, the experiences of these apprentices who are enrolled in a formal training program are likely to be better than most.

CONCLUSION

While training is universally viewed as positive we actually know very little about its effectiveness including general construction safety training such as an OSHA 10 hr, or more specific fall prevention training delivered through tool box talks or in school training for workers such as these [Saarlea, 1989; Lingard and Rowlinson, 1997]. As we seek to understand more about the effects of training, these focus groups demonstrate clearly the importance of measuring intermediate measures. Because falls are relatively rare events, discerning differences in injury rates will be challenging, even in intervention studies of respectable size. Pre- and post-tests, that are often used to assess changes in knowledge after training, provide no information on whether the knowledge learned is actually applied.

The data from these focus groups provide compelling evidence that apprentices often do not apply safety principles that they are taught in school in the actual work environment. We were able to identify specific issues that may influence the behaviors of inexperienced workers including the behavior of co-workers, work norms including speed of work, and their own perceptions of risk. The tendency to ‘‘just do what you are told,’’ particularly among more inexperienced apprentices, could be beneficial if the modeling and demands were for safety, implying that a strong policy from more experienced crew could mandate safe behavior of apprentices.

Because the job sites of construction workers change frequently, and because the workers are involved in making the changes, these workers have the capacity to have a positive impact on the safety environment. This is an aspect of construction that can be viewed as an opportunity, and you could argue that these workers are ones that could be empowered through training.

However, our findings illuminate how attempts to empower workers through training alone can fall short. For the opportunity to be effectively realized, workers must have appropriate knowledge and access to equipment, and safety practices must be an ingrained part of their work culture. In the absence of appropriate support from more seasoned co-workers and an appropriate safety infrastructure from contractors for whom they work, these residential carpenters at the bottom of the power structure report knowledge of safety procedures that they do not use. Lastly, the findings illustrate the potential vulnerability of inexperienced workers—even white males in a union environment.

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APPENIDIX

Definitions of Construction Terms Referenced in the Manuscript

Top plate: The top of a framed wall

"Riding the ridge": Working on top of a roof truss, usually to attach a stay lathe.

Ladder jacks: Term used to refer to a combination of extension ladders, "pics" or braces hooked to the ladders (to hold planking), and boards that form work surface. The pics and planking must be moved by hand up the extension ladders as the work height changes.

Pump jacks: Create similar work platform as ladder jacks with planking run between braces; a pumping mechanism is used to raise the work platform

Pic board (stretch boards): Boards extending between two surfaces to form a working platform. The board either rests on a support such as a saw horse, or is attached by a hook mechanism as in a ladder jack or is attached to a stabilized vertical support as in a pump jack.

Trusses: A structural component of the roof employing one or more triangles that are stick built onsite or manufactured and delivered to the worksite. Manufactured wooden trusses are often used in a modern roof assembly to reduce the amount of material and labor used to frame a roof. Trusses will typically clear span the building.

Piggy backs: When roof trusses are too tall to be manufactured or delivered, manufacturers "cap" the trusses and provide piggyback trusses which will form the peak of the roof.