

Features

**PERSPECTIVES OF RESIDENTIAL CONTRACTORS
ON NAIL GUN SAFETY**

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ABSTRACT

Perspectives on nail gun safety were sought from residential contractors as part of an injury surveillance and prevention effort (2005-2008). Anonymous surveys inquired about tool use, training, injury risk, and awareness of the 2003 American National Standards Institute (ANSI) standard calling for shipment of pneumatic nail guns used in wood framing with sequential actuation. Despite some awareness of inexperience, lack of training, speed and tool design in injury causation, 55 percent consistently reported injuries resulted from worker carelessness. Contractors reported safety experiences of their employees were considerably better than those of other residential contractors. After five years, only 16 percent reported any awareness of the voluntary standard. These findings raise questions as to what gains can realistically be expected from passage of voluntary standards such as the one described here. Given that the epidemiology of acute injuries from pneumatic nail guns is now well-described, the safer sequential trigger should be required to protect workers.

Nail guns are ubiquitous in residential construction. These tools were designed to increase productivity by rapidly sinking large framing nails into dense lumber. They are now also available for specialty uses such as finishing, flooring, and hanging metal joist hangers. The tools are typically pneumatic (powered by air from a compressor), but they can be charge activated or battery powered.

These tools are technically easy to operate and it is not uncommon for their use to be assigned to relatively unskilled workers [1]. Unfortunately, ease of use does not necessarily translate to safe use and these tools are associated with risk of acute injury to users [1, 7, 8]. Most of these injuries involve puncture wounds to the hands and fingers [2-8] from discharged nails; these injuries can carry significant risk to individuals who rely on their hands in their work. Additionally, there are cases of serious injury involving other body areas and organs [9-21] and even death [22, 23] related to use of these tools.

The tools have two common trigger configurations, or actuation systems, which to the user look the same. Risk of injury is twice as high among users of tools with contact trip triggers which will fire anytime the nose piece of the gun and the trigger are both depressed. This is in contrast to tools with sequential triggers which require that the nose be depressed *prior to pulling the trigger* in order to discharge a nail. [See Figure 1] The sequential trigger prevents unintentional firing that can occur with recoil following discharge of a nail. The fact that the trigger has to be pulled after the nose piece is depressed also prevents users from shooting themselves or a co-worker if their finger is on the trigger of the gun. Lack of training is also a known risk factor for injury, but contact triggers are more dangerous even among trained users and carpenters with more experience [4, 5, 24].

In 2003, the International Staple, Nail, and Tool Association (ISANTA) sponsored a voluntary ANSI standard that calls for shipping of the large pneumatic nail guns used in wood framing with sequential triggers [25]. However, since the

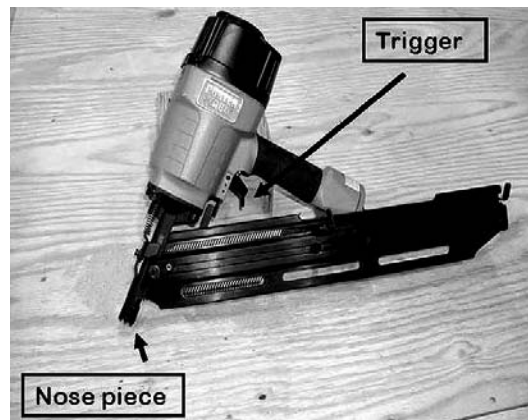


Figure 1. Example of a pneumatic nail gun used in wood framing. Tools with contact triggers will fire any time the nose piece and trigger are both depressed; sequential actuation requires that these two things occur in a specific sequence, namely the nose must be depressed before the trigger is pulled to allow discharge of a nail.

standard calls for *shipping rather than use* of the safer trigger, manufacturers have been able to remain in compliance with the standard while still selling contact triggers including shipping them in the same box with tools fitted with the safer sequential trigger. While residential carpenters usually provide their own hand tools, power tools such as these pneumatic nail guns tend to be provided by the contractor for whom the carpenters work. This circumstance makes contractors important targets for dissemination of safety information since they are essential figures in determining the tools to which carpenters have access. Contractors also bear responsibility for job site safety which includes provision of appropriate training of workers.

In this report, we describe the perspectives of residential contractors on nail gun use and safety. These data were collected as part of a larger project focused on prevention of nail gun injuries among apprentice carpenters.

METHODS

Site of Work

This work was conducted in the area of St. Louis, Missouri, and Southern Illinois; it is one of few areas in the United States with a large unionized residential work force. Residential contractors affiliated with the Carpenters District Council of Greater St. Louis and Vicinity were surveyed as part of a larger nail gun injury surveillance and prevention project conducted with union apprentice carpenters over a four-year period. Numerous findings from this work have been previously reported [4, 5, 24, 26]. As these findings became available, they were shared through the local apprenticeship training programs, the homebuilders associations, and the local union's monthly newsletter sent to carpenters and affiliated contractors.

Survey and Analyses

A short survey was sent to contractors who hired union residential carpenters in each year 2005 (n=104) and 2007 (n=126) using a stratified random sample based on hours of residential work of the contractor in the previous year. In late 2008 and early 2009, all residential contractors who reported hiring any residential union carpenters in 2007 were surveyed (n=299). Letters signed jointly by the investigator, the Executive Secretary/Treasurer of the Carpenters' District Council of Greater St. Louis and Vicinity, and the Executive Directors of the Homebuilders' Associations in St. Louis and S. Illinois explained the survey and sought participation. Up to three mailings were sent to contractors each year. Survey items queried about nail gun use in their business, longevity and purchase patterns, training of workers, perception of risk of injury, injury experience of each contractor's workers and their awareness of the 2003 ANSI standard. One open-ended question asked, "*What factors do you think contribute to injuries from these tools?*" Responses were anonymous.

Straightforward descriptive statistics were calculated for each item to describe the contractors, their experiences, and their perceptions and knowledge. Early responses (from 2005 and 2007) were separated from those from 2008 and 2009. Chi square statistics were used to examine statistical significance of response differences by year. Logistic regression was used to explore the odds of knowledge of the ANSI standard based on year of survey, contractors' experience with an injured worker who required hospitalization or experienced a Workers' Compensation claim with costs of \$10,000 or more, and size of contractor based on numbers of nail guns they reported in use.

RESULTS

The response rate among contractors for whom the union had a current active address and who reported use of pneumatic nail guns was 45 percent; it varied from a high of 57 percent in 2005 to a low of 32 percent in 2007 and resulted in 210 responses. Respondents reported between 1 and 195 nail guns in current service (mean 20). Contractors were divided into low (fewer than 10 nail guns), medium (10-20 nail guns), and high users (more than 20 nail guns) corresponding roughly to tertiles of the distribution. Framing nail guns were most common, although siding, roofing, flooring, finish nailers, and positive placement nailers used in securing joists were all used by these contractors.

In Table 1, we present information about contractors' selection, use, and maintenance of pneumatic nail guns. Nail guns that use strips of nails, common in framing, were more common than coil nail guns used in roofing (framing strip nailers are the ones covered by the ANSI standard). Use of tools with contact triggers was more common than those with sequential triggers and this varied little by year. Some contractors explained policies in place when they purchased pneumatic nail guns with both contact and sequential triggers. For example, some only allowed use of tools with contact trip triggers for flat nailing such as sheathing and some required new apprentices to use tools with sequential triggers. Another reported painting a marker on the contact tools to differentiate them from those with sequential triggers. Factors that most often influenced purchase included brand, performance, and carpenter preferences followed by safety features, costs, design or distributor recommendations. Some distributors provided the nail guns when contractors purchased fasteners from them. About 70 percent of contractors reported their nail guns lasted from one to five years and more than 20 percent reported that they lasted more than five years. Fewer than 25 percent reported any regular maintenance schedule. Common problems reported with these tools included misfires, jamming, dirty tools/lack of maintenance, and O-ring problems/trigger leaks.

A variety of training opportunities were reported to be provided by contractors; hands-on training or toolbox talks were more common. The proportion of contractors who reported providing specific skills or safety training

Table 1. Residential Contractors' Selection and Use of Pneumatic Nail Guns by Year^a

	Percentage (n=95) 2005/2007	Percentage (n=115) 2008/2009
Use of:		
Coil nailers	58.9 (56)	59.1 (68)
Strip nailers	89.5 (85)	93.0 (107)
Supply workers with:		
Framing nail guns with contact triggers	37.2 (35)	37.4 (43)
Framing nail guns with sequential triggers	24.5 (23)	20.9 (24)
Both, contact and sequential trigger tools	30.9 (29)	35.1 (40)
Neither, don't use framing nailers	7.4 (7)	6.1 (7)
Factors that influence purchase:		
Brand, usually buy one brand	60.0 (57)	66.1 (76)
Distributor recommendations	14.7 (14)	15.7 (18)
Performance	61.1 (58)	62.6 (72)
Costs	40.0 (38)	39.1 (45)
Safety features	42.1 (40)	44.4 (51)
Design	20.0 (19)	30.4 (35)
Carpenter preferences	52.6 (50)	53.6 (61)
Pneumatic nailers generally last:		
Less than 6 months	2.1 (2)	0.9 (1)
6-12 months	4.2 (4)	4.4 (5)
1+ to 5 years	66.3 (63)	70.2 (80)
Over 5 years	26.3 (25)	23.7 (27)

^aDifferences in responses by year are not statistically significant.

decreased over time (Table 2). More than half of the contractors allowed first term apprentices to use nail guns; this includes individuals in their first six months of training during which time they may have had little training at the apprenticeship school.

Perceptions of contractors regarding injury risk and their knowledge of the ANSI standard are presented in Table 3. Responses varied little by year and none of the yearly differences are of statistical significance. Carelessness was the most common factor reported to be associated with injury followed by speed, inexperience, lack of training, and tool problems. Other factors mentioned included double firing including when nails hit knots in wood, dangers associated with holding the trigger depressed or bump firing with contact trip

Table 2. Residential Contractors' Provision of Specific Skills or Safety Training Relevant to Nail Gun Use by Year

	Percentage (n=95) 2005/2007	Percentage (n=115) 2008/2009
Provides specific skills or safety training to employees	73.4 (69)	56.5 (65) ^a
Types of training provided:		
Provide pamphlets from manufacturer	10.5 (10)	7.8 (9)
Toolbox safety meeting	52.6 (50)	35.7 (41)
Training course	7.4 (7)	7.0 (8)
Hands-on help; help from other carpenters	62.1 (59)	49.6 (57)
Video or slides	6.3 (6)	0.87 (1)
Manufacturers representative safety training	—	—

^aDifference in response by year is statistically significant ($p=0.01$).

triggers, use of a non-dominant hand, use in inappropriate circumstances, lack of maintenance, weather conditions, hindrance from the hose from the compressor, and worker fatigue.

Contractors' opinions regarding frequency of nail gun injuries among their employees were different from their opinions of injury frequency across residential contractors in general (Figure 2).

Crude and adjusted odds ratios for factors associated with contractors having knowledge of the 2003 ANSI standard are presented in Table 4. Variables of interest were the year of the survey, the contractor's experience with serious injuries (requiring hospitalization or resulting in > \$10,000 in costs), and the type of user based on the number of nail guns reported in service. All were associated with knowledge of the standard. However, overall very few contractors reported awareness of the standard and all estimates are quite imprecise.

DISCUSSION

Among these residential carpenter contractors in the Midwest, the majority of contractors (55 percent) consistently reported nail gun injuries were the result of worker carelessness. There were minimal changes in awareness of the roles of inexperience, lack of training, speed, and tool design in injury causation between 2005 and 2009. A number of the factors reported to be associated with injury risk [1, 4, 5, 7] were described as such by some of the contractors including use of non-dominant hand, conditions of wood, working in awkward postures, or using the tool in inappropriate circumstances. In addition, a number

Table 3. Residential Contractors' Perceptions of Injury Risk and Knowledge of 2003 Voluntary ANSI Standard on Pneumatic Nail Guns by Year^a

	Percentage (n=95) 2005/2007	Percentage (n=115) 2008/2009
How common are nail gun injuries in residential construction in general?		
Not very common	25.5 (24)	21.7 (25)
Somewhat common	30.9 (29)	44.4 (51)
Moderately common	21.3 (20)	17.4 (20)
Quite common	14.9 (14)	13.0 (15)
Very common	4.5 (7)	3.5 (4)
How serious would you say these injuries tend to be?		
Not serious	28.4 (27)	31.3 (36)
Somewhat serious	36.8 (35)	33.9 (39)
Moderately serious	24.2 (23)	28.7 (33)
Quite serious	6.3 (6)	3.5 (4)
Very serious	1.1 (1)	1.7 (2)
What factors contribute to nail gun injuries?		
Carelessness	54.7 (52)	54.8 (63)
Inexperience	3.2 (3)	9.6 (11)
Lack of training	2.1 (2)	3.5 (4)
Speed	15.8 (15)	20.9 (24)
Tool problems	4.2 (4)	7.0 (6)
Are you aware of the ANSI standard for pneumatic nailers? This is a voluntary standard that was updated in 2003. (0.025)		
Yes	10.5 (10)	16.1 (18)
No	69.5 (66)	57.1 (64)
Unsure	20.0 (19)	25.9 (29)

^aNone of the differences in responses by year are statistically significant.

of contractors mentioned the common problem of misfiring which is associated with nail guns with contact triggers [1, 2, 4, 6], however, they did not necessarily report it as a risk associated with tools design. Knowledge of the ANSI standard passed in 2003 was associated with having more tools, having had a serious injury event to a worker and with the response being to the final survey collected in 2008/9. In 2008/9, 16 percent of contractors reported being aware of the standard

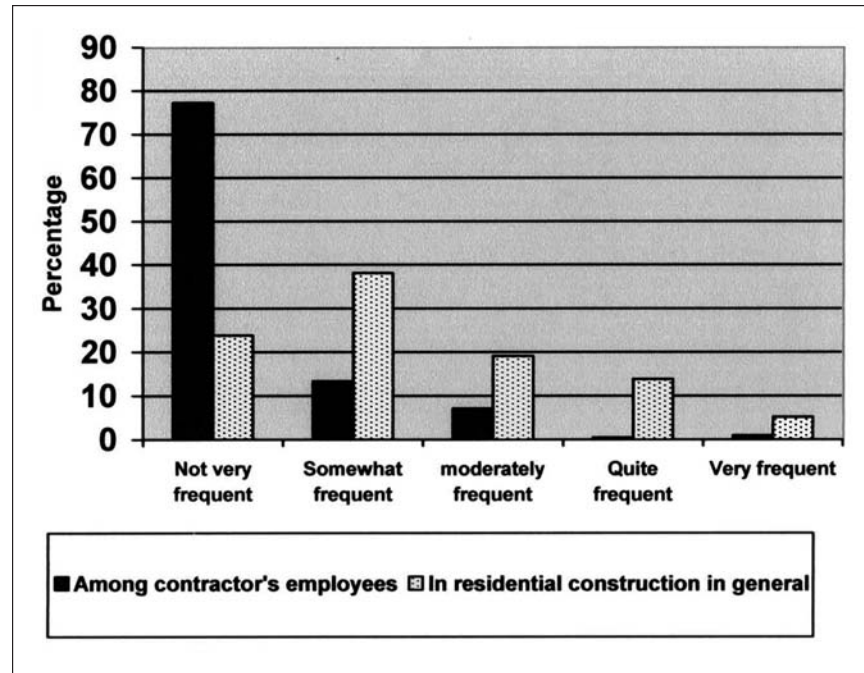


Figure 2. Contractors' perceptions of frequency of nail gun injuries among their own employees and among employees in the residential sector in general.

compared to 10.5 percent in 2005 and 2007. Even among small contractors with high injury rates the total number of injuries of any particular type will be relatively small. Employers with fewer tools and employees may consequently be less likely to note injury patterns and perceive significant risk just as noted here.

Despite considerable evidence to the contrary, including data derived from workers in this geographic area and considerable publicity [30-32], nail gun injuries were not perceived to be very common or very serious. This observation may be related in part to documented under-reporting of many injuries [5, 26-29]. These contractors tended to believe the safety experiences with their employees were considerably better than those of most residential contractors. We did not have any information to link injury experiences of each contractor with their perceptions and we cannot say otherwise. However, we have documented significant under-reporting of injuries among the union workers employed by these contractors for a variety of reasons including perceived lack of severity, peer-pressure to accept injuries as part of the job, behavior-based incentive programs, and direct requests not to report or to file on private insurance [26].

Table 4. Logistic Regression Results Exploring Factors Associated with the Odds of Contractors Knowing about 2003 ANSI Standard

Factors (n=# aware) ^a	Crude odds ratio (95% CI)	Adjusted odds ratio (95% CI)
Year of survey		
2008/9 (n=18)	1.6 (0.68, 3.57)	1.6 (0.67, 3.57)
2005/7 (n=10)	1	1
Type of user		
High user (n=7)	2.89 (1.04, 8.08)	2.94 (1.05, 8.27)
Moderate user (n=10)	1.35 (0.49, 3.75)	1.37 (0.49, 3.80)
Low user (n=11)	1	1
Serious injury experience ^b		
Yes (3)	1.27 (0.35, 4.52)	1.38 (0.38, 5.1)
No (25)	1	1

^aNumber of contractors aware of standard.

^bHad a Workers' Compensation claim costing more than \$10,000 or had a worker hospitalized for a nail gun injury.

The decrease in the proportion of contractors reporting the provision of any nail gun skills or safety training to their workers is of note and of concern. In 2002, based on earlier research findings [1, 7] nail gun training was initiated in the apprenticeship schools. Efforts were made to reach early apprentices, which may have influenced some contractors' offerings if they felt training was covered elsewhere.

Our ability to identify and reach residential contractors in this area of the Midwest was facilitated by the joint labor-management arrangements between local contractors and the union. However, efforts to reach more contractors were hampered by the marked economic downturn in the residential construction industry during this period. Despite limitations associated with a 45 percent response rate from a limited number of contractors, these data provide some important insight into perceptions of residential contractors about nail gun safety. Furthermore, we know of no greater participation among residential contractors in such an effort to have been previously reported.

CONCLUSIONS

Despite the fact that tool design and lack of training are significant risk factors for acute injuries from pneumatic nail guns [1, 2, 4, 7, 8], most of these residential contractors reported nail gun injuries as due to carelessness. Such

beliefs likely foster the blaming of workers for their injuries and make it less likely that contractors will focus on effective prevention measures such as the purchase of safer tools and provision of training in safe tool use. Furthermore, we observed minimal differences in the proportions of contractor responses over time despite considerable attention to safety problems associated with nail guns in this specific geographic area. These data do not provide information on whether the contractors saw informational materials provided in the St Louis area and did not agree with the presentation or if they had never seen them; however, such opinions should not have influenced their knowledge of the ANSI standard which was also very low. In any event, the findings document needs for more information on how residential contractors acquire safety information and what influences their opinions and behaviors.

Five years after the 2003 ANSI standard calling for the shipping of framing nail guns with sequential triggers, only 16 percent of residential contractors reported having any awareness of the standard. Since pneumatic nail guns were reported to commonly last one to five years, it is clear that workers continue to have exposure to tools purchased a number of years ago. Our findings raise a question as to what can realistically be expected from passage of voluntary standards such as this one. In the absence of any requirement to disseminate information to relevant audiences, the manufacturers and tool association have no pressure to explain the rationale, or acknowledge the lack thereof, for changes represented in a weak voluntary standard such as this one. Given that the epidemiology of acute injuries from pneumatic nail guns is now well-described, the safer sequential trigger should be required to protect workers.

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