Adoption and Diffusion of Safety Improved Nail Guns

Jim Albers[1], Brian Lowe[1], Hester Lipscomb[2], Stephen Hudock[1], and Ming-Lun Lu[1]
[1]National Institute for Occupational Safety and Health, Cincinnati, Ohio, USA
[2]Duke University Medical Center, Durham, North Carolina, USA

The U.S. National Institute for Occupational Safety and Health (NIOSH) is conducting a study of pneumatic nail gun safety and ergonomics, with the goal of moving toward a reduction in nail gun-related injuries in the U.S. Despite epidemiologic evidence showing the superiority of the sequential actuation trigger for reducing acute traumatic injuries, use of the contact actuation trigger ("bump fire") persists in the U.S. It is not well understood why this is the case. This project will assess users' perceptions and attitudes about pneumatic nail gun trigger systems and will evaluate differences in productivity and musculoskeletal loading between the trigger systems. It is believed that a better understanding of user perceptions about nail gun safety and productivity is critical to inform social marketing efforts with respect to safer nail gun use.

Reports indicate that during 2001-2005, over 22,000 U.S. workers were treated annually in emergency rooms for traumatic injuries resulting from the use of pneumatic-powered nail guns (PNG) (MMWR, 2007). Puncture injuries to the fingers and hands are the most common injuries, although lower extremity injuries, fractures and fatalities have been reported. Analyses of state workers' compensation claims data indicate that PNG traumatic injuries occur more frequently among carpenters employed in wood frame building and residential construction (Baggs et al., 2001, Dement et al., 2003).

All PNGs have a 'nose' at the tip of the gun that must be depressed against the work piece. PNGs with a contact actuation trigger (CAT) can fire nails rapidly in succession by holding the trigger depressed and repeatedly 'bumping' the nose of the gun against the work surface. The sequential actuation trigger (SAT) involves a two-stage process and requires pushing the nose against the work piece before the trigger is depressed. Active surveillance of PNG injuries has shown that use of the CAT trigger significantly increases the risk (RR=2.0) of a traumatic injury and the risk is significantly greater among apprentice carpenters with no training (RR=2.7)(Lipscomb et al, 2006).

Users appear to prefer the CAT trigger mechanism because it is perceived to increase work productivity. However, Lipscomb et al. (2008) found no significant productivity advantage using the CAT for wood framing tasks. Some in the construction industry perceive the SAT increases the risk of specific repetitive motion disorders (e.g., "trigger finger"), although no epidemiologic data exists to support this concern (Baggs et al., 2001, Lipscomb et al., 2003). Unlike the fastening of sheet materials, nail placement during wood framing requires greater precision and the PNG operator's second hand is often placed near the nailing location. One study reported that 70% of residential carpenter PNG injuries were associated with wood framing activities (Lipscomb et al., 2007).

To reduce PNG injuries, the trade association representing PNG manufacturers sponsored the effort to revise the ANSI 'power fastener' safety standard to encourage PNG manufacturers to provide both contact actuation and sequential actuation triggers (ISANTA, 2002). Despite the ISANTA recommendation that stakeholders "choose a trigger system for their specific needs" use of the CAT mechanism appears to be prevalent in all types of work. Three years after the ANSI standard was released, 28,500 work-related nail-gun injuries were estimated to have been treated in U.S. emergency rooms (MMWR, 2007).

A NIOSH research project is using a multi-level approach to evaluate and compare ergonomic/biomechanical factors, productivity factors, and users' perceptions associated with the SAT and CAT mechanisms. NIOSH is using Contextual Design methods to investigate PNG use patterns, attitudes, and beliefs regarding injury risk and prevention. NIOSH will also conduct experiments to determine whether the CAT provides a productivity advantage for fastening sheet materials where productivity may be more of a concern and whether use of the SAT increases risk factors for "trigger finger". The results of this investigation will inform the development and dissemination of communication products tailored to the construction industry for the purpose of reducing PNG injuries.

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