Use of voluntary controls for physical risks in Sheet Metal Work tasks

Ann Marie Dale[a], Bethany Gardner[a], Laura Welch[b], Bradley Evanoff[a]

[a] *Division of General Medical Sciences, Washington University School of Medicine, St. Louis, MO, USA;* [b] *The Center for Construction Research and Training, CPWR, Silver Spring, MD, USA*

1. Introduction

Sheet metal workers are at particularly high risk for developing work-related musculoskeletal disorders (WRMSD), with one of the highest rates of overexertion injuries among all construction trades (Fredericks, Abudayyeh, Palmquist, & Torres, 2002; U.S. Bureau of Labor & Statisitics, 2013; Welch, Hunting, & Kellogg, 1995). Specific MSD symptoms have been linked to common exposures found in general construction work (Engholm & Holmström, 2005). There have been few changes in the tools and tasks performed by sheet metal workers over the years, supporting the continued high rates of WRMSD among sheet metal workers.

In 2002, the National Institute for Occupational Safety and Health (NIOSH) held stakeholder meetings to develop a plan to address the high injury rates. During trade-specific breakout sessions, stakeholders discussed the perceived risk of work tasks, availability of ergonomic controls, and perceived barriers to controlling hazards (Albers, Estill, & MacDonald, 2005; National Institute of Occupational Safety and Health, 2006). The group created a prioritized list of problematic work tasks and recommended interventions for each task. Most of the interventions could be implemented by the contractor although some interventions required support from the general contractor, or long-term planning to be built in to the project design. These recommendations were made publically available in 2005.

There is no data available in the United States to track voluntary control measures being implemented in high-risk tasks (Albers et al., 2005; Andersson, 1990; Wos, Lindberg, Jakus, & Norlander, 1992). A recent workshop assembled a group of researchers, tool manufacturers, contractor associations, and insurance industry representatives to explore the challenges of transferring technology to workers engaged in appropriate work tasks. The complex construction environment presents unique challenges for transferring technologies into the hands of workers (Center for Construction Research and Training, 2012).

2. Practice Innovation

The purposes of this study were 1) to determine whether previously recommended voluntary control measures to reduce physical exposures in sheet metal tasks were being utilized in commercial sheet metal projects and 2) to describe the postures and loads associated with residual WRMSD risk that were observed for these jobs.

3. Sources of Information

Stakeholder groups identified six sheet metal work activities and associated tasks, assigned a risk level (High, Moderate, Low) and body region potentially affected for each task, and suggested solutions to address the risk in each task. This framework was used to evaluate the work method and use of stakeholder-suggested solutions in a series of case studies. Sixteen commercial sheet metal worksite assessments collected between 2007 and 2009 were reviewed. The reviewers determined whether the methods used to perform each activity incorporated any ergonomic controls including the stakeholder-suggested solutions or novel solutions not previously described. The review included an analysis of the video from each case study using the Multimedia-Video Task Analysis (MVTA) software which assists with automating time studies of observable activities (Ergonomics Analysis and Design Research Consortium, 2003). Time studies in tasks and posture ratings were collected using previously described methods (McGaha, 2014). Analysis included a description of the type and number of tasks that used old methods, recommended methods, and novel methods and the proportion of time with high risk in tasks.

4. Findings

Video analysis described four sheet metal activities with high to moderate risk tasks including pack (move material), support system (install hangers), prep (assemble duct), and install ductwork or equipment. Some stakeholder-suggested solutions were observed for each activity although not for each task of the activity. Workers commonly employed stakeholder-suggested mechanical handling equipment to pack heavy objects;

many workers were observed to use power-tools in place of manual tools. Few alternative risk-reduction methods were observed for tasks involving overhead or extended reach such as for drilling and duct installation. Novel solutions were seen to preassemble duct and supports before overhead installation and worker-designed manual assist devices. A large portion of time was spent in poor back postures (41%) during prep tasks and poor shoulder postures (39%) during support system tasks.

5. Discussion

Adoption of recommended solutions is limited. Some sheet metal tasks have few or no interventions available. Workers remain at risk for developing WRMSDs, particularly for the low back and shoulders. Future solutions should explore system designs that eliminate overhead work.

6. Acknowledgements

This study was supported by research funding from the Centers for Disease Control / National Institute of Occupational Safety and Health (R01 OH008017-01 and U60OH009762-01). Its contents are solely the responsibility of the authors and do not necessarily represent the official view of NIOSH. These funds were used by the research team in order to design the study, and to perform the data analysis and interpretation, and to prepare this manuscript. The study sponsors had no specific involvement in this manuscript.

7. References

Albers, J., C.Estill, and L.MacDonald. 2005. "Identification of ergonomics interventions used to reduce musculoskeletal loading for building installation tasks." Applied Ergonomics. 36(4): 427-439. doi: 10.1016/j.apergo.2004.07.005

Andersson, R. E. 1990. "The adoption process for an ergonomic intervention [Abstract]." Swedish Council for Building Research (Byggforskningsradet), Stockholm, Report No. R76, 50pp.

Center for Construction Research and Training. 2012. "Best practices for health and safety technology transfer in construction." Available from: http://www.cpwr.com/sites/default/files/research/cpwr-report-102412.pdf.

Engholm, G., and E.Holmström. 2005. "Dose-response associations between musculoskeletal disorders and physical and psychosocial factors among construction workers." Scandinavian Journal of Work Environment, & Health 31 (2): 57-67.

Ergonomics Analysis and Design Research Consortium. 2003. "User's manual for Multimedia Video Task AnalysisTM (MVTATM)." Wisconsin Alumni Research Foundation (WARF), Wisconsin.

Fredericks, T., O.Abudayyeh, M.Palmquist, and H.Torres. 2002."Mechanical contracting safety issues." Journal of Construction Engineering and Management-Asce 128(2): 186-193. doi: 10.1061/(asce)0733-9364(2002)128:2(186)

McGaha J., K.Miller, A.Descatha, L.Welch, B. Buchholz, B.Evanoff, and A.M. Dale. 2014. "Exploring physical exposures and identifying high-risk work tasks within the floor layer trade." Applied Ergonomics 45(4):857-64.

National Institute of Occupational Safety and Health. 2006. "Proceedings of a meeting to explore the use of ergonomics interventions for the mechanical and electrical trades." Cincinnati: National Institue for Occupational Safety and Health.

U.S. Bureau of Labor Statisitics. 2013. "Incidence rates of nonfatal occupational injuries and illnesses by industry and case types 2011." Bureau of Labor Statistics, United States Department of Labor. Available from http://www.bls.gov/iif/oshwc/osh/os/ostb3191.pdf

Welch, L., K.Hunting, and J.Kellogg. 1995. "Work-related Musculoskeletal Symptoms Among Sheet-Metal Workers." American Journal of Industrial Medicine, 27(6): 783-791. doi: 10.1002/ajim.4700270603

Wos, H., J.Lindberg, R.Jakus, and S.Norlander. 1992. "Evaluation of impact loading in overhead work using a bolt pistol support." Ergonomics, 35(9): 1069-1079.