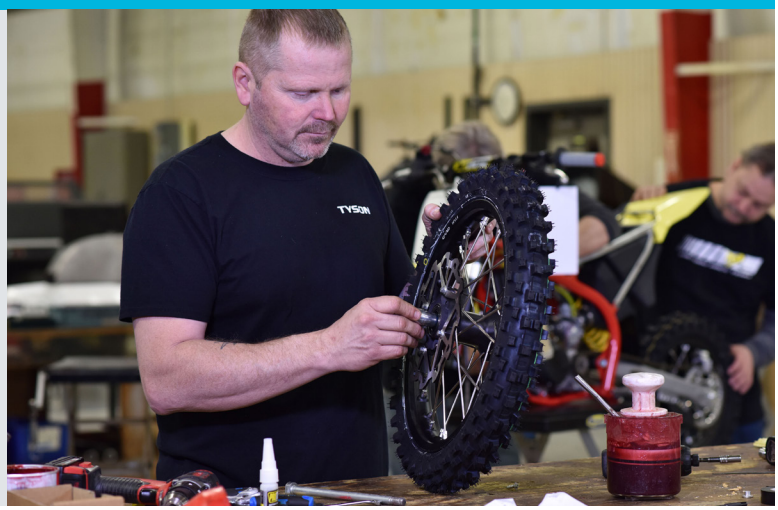
Humantech's Position

Hierarchy of Controls for Musculoskeletal Disorders



Introduction

The *hierarchy of controls* is a model used by safety professionals to illustrate and determine feasible and effective methods for reducing exposure to hazards. There is no single definitive model, but a rather wide range of interpretations of the model with some common terms and order (Coble, 2015). The model is general, so it can apply to a broad range of hazards in the workplace (electrical, chemical, physical, etc.). We have refined the hierarchy of controls model, making it specific to managing the risk factors (hazards) known to cause musculoskeletal disorders (MSDs).

Our hierarchy of controls model for MSD risk is a refinement based on current models of leading agencies and institutions. Our position is that there are five general levels of controls. These reflect the current research on effectiveness of MSD controls, providing a focused model from which to plan and determine workplace ergonomics improvements. The descriptions are simple, intuitive, and specific, to improve communication, understanding, and application by employers in a wide range of industries.

The hierarchy of controls provides safety professionals with a proven framework with which to evaluate, select, and plan effective and efficient controls for reducing workplace hazards.

Figure 1: Hierarchy of Controls for MSDs

Our model is a refined decision-making tool specifically for selecting controls that reduce or eliminate the causes of MSD injuries. In addition, the name of each level reflects the current proven and accepted controls for MSD risk.

MSD Hazards

The risk factors known to cause MSD injuries have been determined and thresholds for exposure have been identified and quantified (NIOSH, 1997), providing a foundation for conducting objective risk assessments. From current research, we know that the three primary risk factors that cause MSDs are:

- Awkward posture
- High force
- Long duration or high frequency

Figure 2: Primary MSD Risk Factors

Secondary contributing risk factors include:

- Soft tissue compression
- Low temperatures
- Vibration
- Impact stress
- Glove issues

Exposure limits to these MSD risk factors vary with the different joint structures of the body (neck, back, elbow, wrist, etc.) and enable use of quantitative MSD risk assessment tools to determine the amount of exposure to a person performing work. This focus on MSD risk factors alone allows the hierarchy of controls to be specific to MSD injuries.

Levels of Controls

Our model has five levels, which reflect the three to six levels presented in NIOSH, OSHA, Canadian, and European Union models (Coble, 2015; NIOSH, 2015; OSHA, 2016). The model further groups the levels into three types of controls that reflect how the control is put in place.

- **Engineering:** Changes in the physical setup of the workplace and job that eliminate or reduce exposure to MSD risk factors. "Well-designed engineering controls… will typically be independent of worker interactions" (NIOSH, 2016).
- **Administrative**: Changes to work pace and/or workforce that control or reduce exposure to risk factors. "These measures include additional relief workers, exercise breaks, and rotation of workers. These types of controls are normally used in conjunction with other controls that more directly prevent or control exposure to the hazard" (OSHA, 2015).
- **Other:** Personal protective equipment (protective devices worn by the person performing work). Effective PPE for exposure to MSD risk factors has not been validated, so this section of the Humantech model has been renamed and expanded to reflect other approaches to managing MSDs (stretching, fitness, job matching, etc.) (NIOSH, 1983, 1994, 2013; OSHA, 2003, 2008).

These three groupings offer important clarification when communicating the effectiveness of each level of control to leadership.

NIOSH (1997) defined occupational ergonomics as, "The science of fitting workplace conditions and job demands to the capabilities of the working population. Ergonomics is an approach or solution to deal with a number of problems—among them are work-related musculoskeletal disorders." This means that ergonomics is the solution, or control, for human performance issues including MSD injuries. These controls can further be mapped to the MSD risk factors they affect.

		Primary MSD Risk Controlled		
Group	Control	Awkward posture	High force	Long duration/ high frequency
Engineering Controls	Eliminate	Y	Y	Y
	Equipment Change	Y	Y	Y
Administrative Controls	Job Rotation & Schedule	N	N	Y
	Work Instruction & Coaching	N	N	N
Other	Other	N	N	N

Table 1: Application of Controls to Primary MSD Risk Factors

The effectiveness of engineering and administrative controls has been described by OHSA (2016), NIOSH (2015), and other organizations. A comprehensive evaluation of the cost effectiveness of ergonomics improvements by Goggins, et al (2008) quantified the greater return from engineering improvements than from administrative controls.

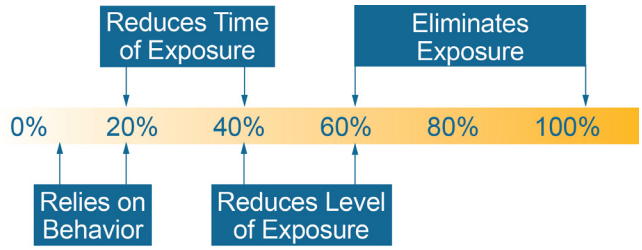


Figure 3: Cost Effectiveness of MSD Risk Reduction Methods

We can align the results of this study with our hierarchy of controls model:

Humantech Hierarchy of Controls Model	Goggins, et al. Study Results
Eliminate	Eliminate exposure
Equipment Change	Reduce level of exposure
Job Rotation & Schedule	Reduce time of exposure
Work Instruction & Coaching	Relies on behavior
Other	

Table 2: Alignment of Humantech Model with Study Results

"Other" Controls

A significant change in the Humantech hierarchy of controls model is replacing the third category, traditionally called PPE, with "Other". PPE is included as a subset of this category because there is limited evidence that the few devices designed to protect a person from exposure to MSD risk factors actually do so (NIOSH, 1997). The Other category includes the range of approaches employers apply to manage MSDs (Rostykus, et al., 2013) such as pre-employment testing, job matching, stretching, fitness, and conditioning.

OSHA requires that many types of PPE devices meet or be equivalent to standards developed by the American National Standards Institute (ANSI). Currently, ANSI standards exist for anti-vibration materials (e.g., "anti-vibration" gloves), but this affects only vibration, a secondary MSD risk factor.

Some consider back belts and wrist splints to be PPE for the prevention of MSDs. OSHA does not include PPE for MSD risk factors in its guidance on PPE (OSHA, 2003), and ANSI

standards have not been established for back belts or wrist braces. Although back belts are commercially available and some do wear them at work, NIOSH concluded in 1994 that there is not significant evidence to prove their effectiveness. The evidence that braces, wrist splints, and similar devices are effective in preventing MSDs is inconclusive (NIOSH, 2000; Rempel et al., 1994). Research has shown some negative implications from the use of back belts including muscle atrophy and compromising joint stability.

For these reasons, the last control on the model is titled Other. This is to reflect non-engineering and non-administrative controls that employers may use.

Conclusion

This model for the hierarchy of controls for MSDs provides a simple and valid foundation for discussing, determining, and implementing effective and efficient methods to eliminate or reduce exposures in the workplace. It allows simple interpretation and understanding by leadership, middle management, employees, and non-safety professionals.

Endorsement

This position statement was accepted by Senior Leadership on May 25, 2016.

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