

Workplace Health and Safety Bulletin



Lifting and Handling Loads – Part 1 Reviewing the Issues

This is the first in a three-part series of Safety Bulletins dealing with the lifting and handling of loads.

Also known as manual handling or manual materials handling, the lifting and handling of loads including lifting, lowering, pushing, pulling, carrying, holding, dragging and supporting objects. The injuries caused by such work are referred to as musculoskeletal injuries, or MSIs. These are injuries of the bones, joints, ligaments, tendons, muscles, and other soft tissues.

Musculoskeletal injuries are the leading cause of compensable lost-time claims in Alberta. In 1999, 29.5 percent of all lost-time claims were due to these types of injuries, or about 200 every week of the year. Readers of this Safety Bulletin should refer to the six-part Safety Bulletin series titled *Musculoskeletal Injuries* for additional detailed information. MSIs are classified into two groups.

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Overexertion injuries

Overexertion injuries involve tissues such as muscles, tendons, and ligaments. These tissues become damaged when they are subjected to a single traumatic event that exceeds their strength or range of motion. The result is a sprain, strain or tear injury. Lifting, pushing or pulling injuries are often of this type.

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Overuse injuries

As the term suggests, overuse injuries occur when tissues are used too much and the body is unable to repair the damage. Repeated small injuries to tissues add up over time, taking hours, days, months, or years to appear. Gripping, reaching, bending and twisting tasks are often associated with workplace overuse injuries. The lifting and handling of loads can often require such actions and therefore the risk factors contributing to overuse injuries need to be considered.

Risk factors

Workers performing their jobs should not be in any pain or discomfort. Actions should be performed smoothly and in control, without sudden or jerky movements. The worker should be able to maintain a balanced and comfortable posture while working. Extreme ranges of joint movement should be avoided, especially when the work is prolonged or repetitive. Repetitive bending, twisting and overreaching movements are among those liable to increase the risk of injury. The risk of injury also increases if

- (a) the loads is not shared evenly between both hands, or is lifted by only one hand;
- (b) the load or object is pushed or pulled across the body from one side to the other;
- (c) the worker needs to bend to one side or other to lift an object or exert a force; and
- (d) the worker performs the handling task while in an awkward body position.

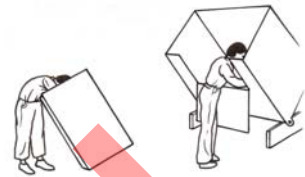
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Three major factors contribute to these types of injuries: awkward body positions, excessive force (forceful exertions), and repetition.

Awkward body positions

The key to reducing or eliminating the use of awkward body positions and work postures is to understand why they are being used in the first place. Awkward positions are often the result of the location and orientation of the object being worked on, poor workstation design, product design, tool design, or poor work habits. Several of these caused can be engineered out, eliminating

the problem altogether. For example, a worker who bends over to lift objects out of large bins or cardboard boxes must assume an awkward body position. Raising and tilting the bins can easily eliminate the awkward position. Less-than-optimal postures such as leaning forward from the waist for extended periods of time, or bending the neck downwards at an exaggerated angle can load muscles with “static work”. Static work involves muscles being tensed in fixed positions and over time, becoming tired, uncomfortable, and even painful.



Forceful exertions

Forceful exertions can overload muscles, tendons (tendons connect muscle to bones), and ligaments (ligaments connect bones to bones). Forceful exertions are commonly used when lifting, pushing, pulling and reaching. A packer on an assembly line for example, may often use a highly forceful grip to assemble a lightweight item or lift a box or carton, especially if it is slippery or difficult to grasp.

Repetition

Repetitive movements eventually wear the body down. Without sufficient time to recover between repetitions, muscles become tired and may cramp. Additional muscle try to help but they may also become tired, cramp and become injured. How quickly this happens depends on how often a repetitive motion is performed, how quickly it is performed, and for how long the repetitive work continues. Repetitive work is more of a problem when combined with awkward body positions and forceful exertions. A worker who packages a small product day after day or who manually loads pallets all day are examples of workers performing repetitive handling work.

The hidden injury, the hidden cost

Overexertion and overuse injuries don't kill workers, but they can have a devastating impact on their lives and livelihoods. A worker in pain loses the ability to concentrate, reducing the quality and productivity of their work. A worker with muscle

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weakness may struggle to perform manual tasks, and may not be able to perform them at all. A worker with damaged nerves loses accuracy and placement in fine work, becomes clumsy and inaccurate, and may not respond quickly to danger. A worker with restricted movement may not be able to complete tasks or can only complete them by putting their body into awkward positions, positions that can cause additional problems.

At the end of the workday, all these problems are taken home by the worker. Pain, weakness, sensory loss due to nerve damage, and limited movements can interfere with family responsibilities and relationships. Workers may not be able to prepare meals, maintain a clean home, perform household maintenance, or enjoy their hobbies. Parents may lose the ability to hold their children. These physical limitations can lead to emotional stress, damaged relationships, and loss of self-worth.

Just a cost of doing business?

Many employers have considered handling injuries to simply be one of the costs of doing business. While still widespread, this attitude is changing. An increasing number of employers and workers are realizing that the costs, both in terms of human suffering and compensation costs, can be avoided by dealing with a problem that is largely preventable. To be successful,

- (1) employers need to identify, assess, and modify (if necessary) the handling tasks they require their workers to perform; and
- (2) workers need to understand what is happening to their bodies and begin to use alternative methods of handling loads so they can avoid injury.

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Reducing the risk of injury

To reduce the risk of injury due to the lifting and handling loads, employers need to review the work being done and prioritize their efforts as follows:

- (1) Try to reduce or eliminate the need to have workers handle loads manually.

- (2) If manual handling cannot be completely avoided, a hazard assessment of the work should be performed. The assessment should focus on the design of loads, equipment and mechanical aids, organization of the work, and the layout of workstations and the workplace.
- (3) Workers should be trained so that they can help minimize the hazards and therefore the risk of injury.

Assessments of lifting and handling jobs often focus on getting the worker to do the job “right”, or “lifting properly”. Although the final solution to the materials handling problem may involve a combination of workplace and worker adjustments, the initial assessment should focus on workplace solutions, not the worker. To be effective, workplace solutions should focus on three areas.

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Automation

Jobs that are very physically demanding, highly repetitive, or performed in a hazardous environment should be automated. Because of the potentially high initial cost of this approach, it is most appropriate when designing new work processes or expanding existing ones.

Mechanical aids

Where the physical demands of the job are significant and automation impractical, mechanical aids should be used. Mechanical handling equipment includes hand trucks, cranes, hoists, scissor lifts, conveyors, powered mobile equipment and lift trucks, overhead handling and lifting equipment, and vacuum lift devices that provide mechanical advantage during the handling task. Equipment as simple as wheeled platforms for garbage containers can help to avoid worker injury.

Modifying the job through redesign

Redesigning the job involves modifying the work process and workstation to reduce bending, twisting, reaching, heavy lifting, excessive forces and highly repetitive motions. Work activities involving less weight, less repetition, less time spent in awkward positions and less applied force are less likely to cause injuries.

And it is very likely that productivity will increase and quality improve.

Advantages of workplace solutions

Focusing on workplace solutions has several advantages over worker-focused approaches to reducing injuries.

- (1) They do not depend on the worker's capabilities, such as their strength and conditioning, to prevent injury. A worker's personal strength and conditioning may change over time; if they decrease, the worker may be more susceptible to injury. A replacement worker may become injured because they do not have similar strength or conditioning, or are unable to meet the physical demands of the work.
- (2) Compared to approaches that focus on the worker, such as extra training, physical conditioning, and worker-specific protective equipment (all of which may be temporary solutions), modifying the job through redesign is a relatively permanent change because the workplace hazard is eliminated.
- (3) Problems arising from trying to change worker behaviours and potential worker discrimination issues are less likely.

Training

The goals of providing training to workers involved in the lifting and handling of loads are to

- (1) prevent injury;
- (2) have workers understand how their work affects their bodies; and
- (3) have workers understand how to perform their work safely without injury.

Training must go well beyond telling workers to “lift with your legs, not with your back” and “lift carefully”. The available evidence shows that training workers in “safe” lifting techniques alone is unlikely to have a sustained impact on injury rates. Training is essential but often not enough.

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To be effective over the long term, training should include

- (a) a review of the hazards associated with the lifting and handling of loads;
- (b) a review of the potential effects on the body of lifting and handling loads;
- (c) a review of the risk factors associated with injuries due to lifting and handling loads;
- (d) guidance on how to reduce or eliminate these risk factors; and
- (e) how to use mechanical aids safely.

Work methods and workplace practices

The problem

Over time, the human body adapts to the demands and stresses placed on it in a process often referred to as “work hardening”. However, without any noticeable change in the demands of the work, even “hardened” workers may develop injuries. This lowered tolerance to injury may be the result of work methods and work demands that finally exceed the worker’s capacity to perform them, or exceed the ability of the worker’s tissues and joints to recover.

Over time, the human body adapts to the demands and stresses placed on it in a process often referred to as “work hardening”.

Work methods that do not reduce or eliminate awkward body positions, excessive forces and repetitive motions, may lead to injury. Work processes that include unnecessary steps or unnecessary handling of materials may influence injury rates and productivity.

The nature of the work, how it is done, and how workers are paid for their work are additional factors to be considered. An incentive or piecework system usually encourages workers to work faster and longer. The increased pace places additional physical and mental stress on the worker, both of which affect their susceptibility to injury. A piecework system may reward workers financially for skipping rest breaks and shortening their meal times. Doing so means that muscles, tendons and ligaments are rarely given a chance to recover from the stresses and strains of work.

Machine pacing, in which the pace of work is dictated by a machine, can lead to similar problems. Workers' lack of control over their work in such situations has been shown to be a source of stress contributing to the occurrence of injuries.

Finally, inadequate or insufficient training can increase risk of injury among workers. Workers must understand how to use their workstation (including how to adjust its equipment and furnishings), how to use or select tools appropriate to the work they are performing, the safe work practices they are expected to follow, and an understanding of the signs, symptoms and methods of preventing injuries.

Potential solutions

The following general principles should be followed when redesigning work methods and workplace practices:

- *automate highly repetitive operations.* Machines are suited to performing highly repetitive activities and stressful tasks. This permits the operator to perform the remaining tasks. Be aware, however, that while the worker no longer performs the more strenuous or dangerous tasks, the remaining tasks become simplified and sometimes reduced to single, repeated actions. These actions may focus forces on smaller, more vulnerable parts of the body, such as the hands and wrists.
- *re-sequence jobs to reduce repetition and eliminate unnecessary process steps.* This may have the added benefits of improving productivity and reducing production costs.
- *job diversity.* Rather than having a worker always perform the same set of tasks within a relatively brief interval, combine several properly selected jobs to provide diversity and reduce monotony and boredom. Jobs with greater diversity often provide workers with a sense of accomplishment.
- *job enrichment.* Workers are given responsibility for a wider range of duties that require a variety of skills and qualifications. As examples, these duties may include work planning, inspection activities, or customer contacts.

- *allow self-pacing of work when possible.* If the pace of work is too slow, workers may lose interest and motivation in their work. Work that is paced too quickly may not provide workers with enough recovery or rest time for those muscles performing the work. Any job design that provides workers with a degree of control over the pace of their work is positive.
- *new workers and those returning to work should start at a slower pace.* Workers should be permitted to get accustomed and conditioned to their work before being expected to perform at peak production. Workers new to a material handling job, or a worker returning to that job following an extended absence, a holiday or illness for example, should be allowed a “break-in” or warm up period of several days to adjust to the job. This allows the worker a period of time in which to build up their skill, ability and fitness to perform the work.
- *allow frequent rest breaks.* Frequent, short breaks from work activities provide workers an opportunity to recover from their activities by stretching, changing body position, or relaxing hard-working muscles.
- *make sure that workers are adequately trained.* Workers need to know how to perform their work safely and comfortably, including understanding the signs, symptoms, and methods of preventing injury.

Lifting “properly”

The most commonly recommended method of lifting loads is to “bend your knees, keep the load between your legs, and lift with your leg muscles”. Unfortunately, if the worker is unable to keep the load between their knees, which is all too often the case, the “proper” method produces extra stress on the back and can lead to injury. Many workers also lack the leg strength to perform repeated lifts from a low-squatting body position.

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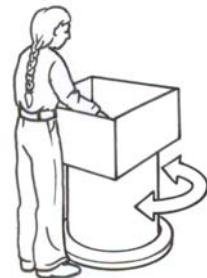
Most scientific studies have found that the lifting techniques has little or no effect on reducing lower back injuries. As a result, instructing workers to use a particular lifting technique is no longer recommended. However, there are a few key points about lifting and lowering that should always be followed

- (1) *Keep the load as close to the body as possible.* This is the first and most fundamental principle of safe lifting and lowering. The closer the load, the less leverage it has in placing injury-causing stresses on the back, shoulders and arms. The closer the load, the more easily it is counterbalanced by the weight of the body and less likely to get out of control.
- (2) *Don't twist while lifting or lowering* – especially with a heavy load. Always turn and take a step. Points (1) and (2) are largely determined by the placement of the feet, which is in turn determined by the presence or absence of obstacles that prevent the worker from getting their feet beneath or around the load. Combined lifting and turning movements are often the result of a poor workstation layout.
- (3) *Lift and lower in a smooth, controlled manner.* The load must not be jerked.
- (4) *Keep the back straight.* Doing so whenever possible, helps to reduce, or better distribute, potentially damaging stresses in the lower back.

Optimizing materials handling jobs

Working height

Moving loads to or from the floor should be avoided. Whenever possible, materials handling jobs should be designed so that they can be performed between mid-thigh and shoulder height. Workers can develop the greatest amount of power and strength within this range.



Frequent or prolonged bending down with the hands below mid-thigh height should be avoided. In both cases, the extremes of movement can place injury-causing stresses and strains on the back, shoulders, and arms.

If the weight of the load is not distributed evenly, the heavier end should be closer to the body. If the load's centre of gravity is offset to one side, then the stronger arm should support the heavier end. Two person lifts can sometimes be used but must be well coordinated. It is important to be aware that two workers *cannot* lift twice the weight that one worker can. In fact, a two-person team can lift about two-thirds the sum of what each individual can lift.

Bending and twisting

Avoiding excessive bending, twisting, and reaching prevents injury. Twisting the body increases the stress on the lower back and reduces the safe load that a worker can handle. The risk of injury increases with increasing frequency, repetition, and duration of the handling activity. How often and for how long an activity is performed are key risk factors to be considered. Lifting even an apparently "light" object can lead to serious injury if it is lifted and moved hundreds or thousands of times during a work shift.

Repetition

Problems with frequency and duration are not restricted to the lifting or lowering of loads. Pushing, pulling, carrying and holding loads can also be a problem if performed frequently or for extended periods of time. The same manual handling task repeated over extended periods of time may lead to monotony and boredom. This resulting reduced level of alertness may have safety consequences.

To reduce these problems, consider job diversity, job enrichment and frequent rest breaks.

Seated work

The seated worker has to rely on their arms and torso for strength. The much stronger leg muscles normally used for lifting cannot be used. The counterbalance effect of the body is reduced, which is why the amount of weight that can be safely lifted while seated is less than that for standing. If the seated worker must maintain an awkward body position or twist while lifting, then the weight that can be safely lifted is reduced even further.

Carefully review the job and the workstation. The weight of the object may not be suitable for seated work or the workstation may need to be redesigned to eliminate hazards.

Pushing and pulling

Whenever possible, loads should be pushed or pulled rather than being lifted and carried. Pushing is generally preferred over pulling because the worker is able to use their body weight to apply force to the load to get it to move. Mechanical devices such as trolleys, carts, skidders, floor jacks, or dollies should be used whenever possible.

Based on research studies, the optimum height of horizontal handles for workers pushing or pulling such equipment is a little below elbow height. Reflecting the range of worker sizes, this means that the optimum handle height is approximately 91 cm (36 in) above the floor but can vary anywhere from 91 to 114 cm (36 to 45 in). Vertical handles are often a better solution because they allow the worker to find the height at which pushing or pulling is most comfortable for them.


The surface of the floor or ground on which the pushing or pulling are being done should be slip resistant so that workers do not slip and fall, but smooth enough that loads can be rolled easily. Good housekeeping becomes important, as does maintenance of the wheels and bearings of the rolling equipment.





Pushing is preferred to pulling with an arm extended.

Other safety bulletins in this series

This three-part series of Safety Bulletins consist of the following titles:


 http://employment.alberta.ca/documents/WHS/WHS-PUB_bcl001.pdf
Lifting and Handling Loads Part 1 – Reviewing the Issues – BCL001


 http://employment.alberta.ca/documents/WHS/WHS-PUB_bcl002.pdf
Lifting and Handling Loads Part 2 – Assessing the Hazards – BCL002


 http://employment.alberta.ca/documents/WHS/WHS-PUB_bcl003.pdf
Lifting and Handling Loads Part 3 – Reducing the Hazards – BCL003


A companion series specific to musculoskeletal injuries is also available. It consists of the following titles:


 http://employment.alberta.ca/documents/WHS/WHS-PUB_erg017.pdf
MSI – Part 1 – Alberta Injury Statistics and Costs – ERG017

 http://employment.alberta.ca/documents/WHS/WHS-PUB_erg018.pdf
MSI – Part 2 – Symptoms and Types of Injuries – ERG018

 http://employment.alberta.ca/documents/WHS/WHS-PUB_erg019.pdf
MSI – Part 3 – Biomechanical Risk Factors – ERG019

 http://employment.alberta.ca/documents/WHS/WHS-PUB_erg020.pdf
MSI – Part 4 – Workplace Risk Factors – ERG020

 http://employment.alberta.ca/documents/WHS/WHS-PUB_erg021.pdf
MSI – Part 5 – Assessing Ergonomic Hazards – ERG021


 http://employment.alberta.ca/documents/WHS/WHS-PUB_erg022.pdf
MSI – Part 6– Reducing Ergonomic Hazards – ERG022


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