



MSI Prevention Guidance Sheet

Risk Factor: Pushing/Pulling/Carrying

Occupational Health and Safety Regulation Section 4.49(a)(i)

Purpose

Worksheets A and B do not address exposure to pushing, pulling, or carrying forces. This guidance sheet can be used to identify and assess the risks of musculoskeletal injuries (MSI) associated with pushing, pulling, and carrying forces.

Description and general concepts

Forces from **pushing** and **pulling** are usually associated with a risk of injury to the arms, shoulders, or back. The risk of injury may come from a single traumatic event, such as pulling a heavy cart with poorly maintained wheels, or from repetitive exertions over a long period of time, such as pulling lumber from a green chain.

Push/pull forces are affected by:

- Worker's body weight and strength
- Height of force application (for example, height of handles)
- Distance from the worker's body at which the force is applied
- Direction of force application
- Size, shape, and weight of the load
- Amount of friction or grip between the floor and the worker's shoes
- Distance over which the object is pushed or pulled
- Frequency of the push/pull task
- Grade of the floor or surface the object is being moved across

The initial force needed to get the object moving is usually much greater than the continuous (sustained) force required to keep that object moving.

Carrying a heavy load is mechanically stressful and energetically demanding. Prolonged carrying of a heavy load will subject the muscles of the arms and back to loading. Moving the whole body and the load (carrying) consumes energy.

Carrying forces are affected by:

- Holding time (determined mainly by the distance the object is carried)
- Type of grip
- Size, weight, and shape of the object (wide objects are more awkward to carry)
- Grade of the floor

Examples

Some occupations that have potential exposure to pushing, pulling, and carrying are hospital workers (pushing or pulling laundry or medical carts), workers in manufacturing jobs (where goods are pushed along rollers or conveyors), workers who pull cables, warehouse workers, and restaurant workers.

When assessing the risk for pushing, pulling, or carrying, you need to determine the weakest link in the task. The weakest link is usually the grasping forces and shoulder muscle strength, not the strength of the legs or back. Direct measurement of forces using a push/pull dynamometer (a strain or force gauge) is the preferred method for assessing the risk of MSI. These values are *not* the same as the actual weight of the object being pushed or pulled.

You can compare the forces you measure with published research data to determine if the pushing/pulling task presents a high, moderate, or low risk of MSI. A number of such guidelines are available and can be used – for example, S.H. Rodgers, 1985; the Snook tables, 1991 (Snook and Cieriello, 1991); or the Mital, Nicholson, and Ayoub tables, 1993. For ease of assessment, a link to a push/pull/carry calculator – based on the Snook tables – is provided:

<http://ergonomics.healthandsafetycentre.org/calculator/ergo/PPCC/intro.htm>

Controls

The employer is required to eliminate or minimize the risk of MSI to workers. Possible solutions include the following options:

1. Eliminate the need to push/pull/carry:
 - Automate pushing, pulling and carrying tasks (examples include using mechanical rollers/conveyors and gravity feed systems).
 - Use mechanical aids such as carts, dollies, or lift trucks or pallet jacks.
 - Avoid carrying wide or tall (bulky) loads.
2. Reduce the forces required to push/pull/carry:
 - Reduce the weight or size of load.
 - Maintain the wheels on carts in good working order .
 - Where practicable, provide handles.
 - Ensure that friction between the floor and the cart wheels is low.
 - Keep the floor clean and free of debris.
 - Wear appropriate footwear to enhance friction and minimize slippage between floor and shoes.
 - Minimize the distances over which objects are to be pushed, pulled, or carried (change the layout of the workplace if necessary).
 - Train workers in the use of correct body mechanics for pushing, pulling, and carrying.