The Physical Job Evaluation Checklist

User Guide

SERVICES
(EXCLUDING PUBLIC SAFETY)

July 2017
SHARP Publication No: 40-23-2017
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THE PHYSICAL JOB EVALUATION CHECKLIST

The Physical Job Evaluation Checklist allows the user to determine the level of risk (low, moderate and high) for developing work-related musculoskeletal disorders (WMSDs) of the back, shoulder, hand/wrist and knee. There are six Physical Job Evaluation Checklists, each specific to an industry. These industries are: Agriculture, Forestry & Fishing; Construction; Manufacturing; Wholesale and Retail Trade; Services (excluding Public Safety); and Health Care and Social Assistance.

This reference guide describes the Physical Job Evaluation Checklist for the Services industry, excluding Public Safety.

Purpose

The intended purposes of the Physical Job Evaluation Checklist are to:

1. Increase general awareness of industry-specific physical factors that contribute to work-related musculoskeletal disorders (WMSDs).
2. Help identify specific aspects of the job that pose a risk for back, shoulder, hand/wrist and knee injury.
3. Help prioritize injury prevention efforts by identifying the jobs, or the aspects of the job that pose the greatest risk of injury.
4. Evaluate the impact that process changes have on WMSD risk (before and after exposures).
5. Compare exposures between workers performing the same or different tasks.

The Physical Job Evaluation Checklist IS NOT intended to predict the occurrence of a WMSDs or to provide guidance or suggestions on how to mitigate exposure to risk factors of WMSDs.

This reference guide will:

- Provide guidance in how to answer each question in the Physical Job Evaluation Checklist.
- Provide information regarding the determination of risk levels.
**Features of the Physical Job Evaluation Checklist**

The level at which a job is evaluated (the unit of analysis) is left to the user, affording some flexibility. This means the evaluation can look at an activity within a task, a task within a job or the entire job. In this checklist we refer to any unit of analysis as “the work”.

The Physical Job Evaluation Checklist does not have to be completed in its entirety. An evaluation can be done for a specific body part (back, shoulder, hand/wrist, knee) or a specific activity, e.g. lifting or pushing or pulling.

**WORK-RELATED MUSCULOSKELETAL DISORDERS (WMSDs)**

The following sections describe work-related musculoskeletal disorders and the methods used to develop the Physical Job Evaluation Checklist. To learn how to use the checklist, proceed to the section “Using the Physical Job Evaluation Checklist”.

**Description**

WMSDs are soft-tissue disorders of non-acute origin that are caused or exacerbated by the work environment. These are conditions of the nerves, tendons, muscles and supporting structures of the musculoskeletal system. WMSDs most frequently occur to the back, shoulders, neck, elbows, hands, wrists, hips and knees. These disorders are a result of workplace physical or psychosocial stressors put on the structures over time. WMSDs include, but are not limited to, carpal tunnel syndrome, tendinitis, tenosynovitis, bursitis, herniated discs, sciatica, epicondylitis, muscle strains and sprains and rotator cuff syndrome. Symptoms of WMSDs include general aching or discomfort, tingling, numbness, swelling, and pain.

**WMSD Risk Factors**

The physical workplace stressors, referred to as risk factors, widely considered to cause WMSDs include:

- Repetitive Motions
• Static Body Postures
• Awkward Body Postures
• Forceful Hand Exertions (excessive pinching or gripping)
• Hand/Arm Vibration
• Whole Body Vibration
• Manual Material Handling (lifting, pushing, pulling and carrying)

Three dimensions of these risk factors are used to determine WMSD risk level:
1. How often? (Frequency)
2. For how long? (Duration)
3. How hard? (Intensity)

The development of WMSDs can result from exposure to a single or multiple risk factors. Research has found that exposure to a combination of physical risk factors increases the risk of WMSDs.

In the United States, in 2015, WMSDs accounted for 31% of the occupational injuries and illnesses that required days away from work. The median number of days away for WMSDs in private industry, a measure of severity of injury, was 12. This compares to a median of 8 days away from work for all injuries and illnesses. In Washington State, between 2010 and 2015, WMSDs accounted for approximately 39% of workers’ compensation claims, resulting in an estimated $16 billion in direct workers’ compensation costs.

DEVELOPMENT OF THE PHYSICAL JOB EVALUATION CHECKLIST

Background
The Physical Job Evaluation Checklist was developed as part of a five-year study on work-related musculoskeletal disorders in Washington State industries conducted by the Safety and Health Assessment for Research and Prevention (SHARP) Program. The Physical Job Evaluation
Checklist was developed using data quantifying the exposure to physical risk factors for WMSDs from companies recruited across Washington State.

Participating companies in the Services industry were classified as the following:

- Landscaping Services
- Hotels (except Casino Hotels) and Motels
- Janitorial Services
- Carpet and Upholstery Cleaning Services

**Methods**

Exposure to physical risk factors of WMSDs was evaluated through direct observations and interviews, using seven existing job assessment tools that are widely utilized by health and safety professionals and researchers. Theses job assessment tools were:

1. Washington State’s Caution Zone and Hazard Zone Checklist 4,5
2. The Strain Index 3
3. The American Conference of Governmental Industrial Hygienist (ACGIH) Lifting TLV 9
5. The Quick Exposure Check1,2
6. The European Union Hand-Arm Vibration Guidelines 8
7. The European Whole-Body Vibration Guidelines 8

Each industry-specific evaluation checklist is comprised of elements from these different assessment tools. These assessment tools were used to quantify the exposure to defined risk factors of WMSDs. Their results were then used to describe the risk of developing WMSDs. The checklist was developed to be as protective as possible, meaning those elements of the various job assessments tools that most frequently identified high risk levels were chosen for inclusion in the Physical Job Evaluation Checklist. The job assessment tool elements that were included in the **Services** industry specific checklist can be found in Appendix One.
Some of the above assessment tools stratified risk on four levels (low, moderate, high and very high) while others used three levels (low, moderate and high). To avoid confusion about the highest possible risk level, for the assessment items where four levels of risk were defined, the two highest categories (high, very high) were combined into one (high).

The following table describes the risk factors assessed for each body part of focus:

<table>
<thead>
<tr>
<th>BACK</th>
<th>SHOULDER</th>
<th>HAND/WRIST</th>
<th>KNEE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Awkward Postures</td>
<td>Awkward Postures</td>
<td>Forceful Hand</td>
<td>Kneeling</td>
</tr>
<tr>
<td>Carrying</td>
<td>Carrying</td>
<td>Exertions</td>
<td>Repetitive Foot</td>
</tr>
<tr>
<td>Manual Lifting</td>
<td>Manual Lifting</td>
<td>Hand Activity</td>
<td>Motions</td>
</tr>
<tr>
<td>Pushing/Pulling</td>
<td>Pulling</td>
<td>Hand/Arm</td>
<td>Squatting</td>
</tr>
<tr>
<td>Whole Body Vibration</td>
<td>Pushing</td>
<td>Vibration</td>
<td>Whole Body Vibration</td>
</tr>
<tr>
<td>Work Pace</td>
<td>Work Pace</td>
<td>Repeated Impacts</td>
<td>Work Pace</td>
</tr>
<tr>
<td>Work Stress</td>
<td>Work Stress</td>
<td>Repetitive Motions</td>
<td>Work Stress</td>
</tr>
</tbody>
</table>

The risk factors evaluated in the Physical Job Evaluation Checklist were restricted to those risk factors assessed by the existing job assessment tools. The definitions of the risk factors were the same as those used in the original assessment tools. Because of this, the checklist might not evaluate some physical factors that may increase the risk of WMSDs of the back, shoulder, hand/wrist and knee. These can include:

- Walking up and down ladders or stairs
- Walking on uneven surfaces
- Working in cold temperatures
- Working in wet conditions
- Prolonged standing in one place without the ability to move about.
- Prolonged sitting without the ability to get up
USING THE PHYSICAL JOB EVALUATION CHECKLIST

Checklist Download

The checklist can be downloaded from:


The minimum system requirements are:

- Microsoft Excel: this is an Excel file (.xlsm), 4 MB in size.
  - The checklist cannot be used with other spreadsheet programs.
- Microsoft Windows operating system only:
  - Running this file in other operating systems will create errors.

Completing the Checklist

To evaluate the work using the Physical Job Evaluation Checklist, follow these steps:

1. Open the program and select an industry.
2. Print and complete the paper form (see example of paper form below).
3. Observe the work and record exposures on the paper form.
4. Transfer the data from the paper form to the Electronic Checklist (see example of checklist below).
5. Review the results page.

The Electronic checklist is comprised of three parts:

1. The Tutorial: Provides the basics of navigating the checklist.
2. Data Entry Pages: Exposure data from the paper form are entered here.
3. The Results Report: Presents the final summary results arranged by body parts and other details.

This checklist can be completed by one person or by group consensus. It is recommended that at least one user has a basic knowledge of workplace injury prevention, job evaluation and physical hazards.
Although this checklist is intended to be relatively quick and easy and does not require an extensive observation period, a more detailed, in-depth evaluation can be accomplished by observing the work over the course of the day or multiple days. When evaluating the work, consider seasonal or temporal shifts in the work, with respect to either the job demands or the activities performed.

This checklist is designed so that the work to be evaluated is determined by the user. This checklist can be used to evaluate a single work activity of the “job”, multiple activities or the entire job.

There are different methods of gathering exposure data to complete assessments:

- Method 1: Observe one worker as a representative for all the workers.
- Method 2: Observe several workers and record the most common scenario among them.
- Method 3: Observe several workers and record the worst case scenario among them.

**USING THE PHYSICAL JOB EVALUATION CHECKLIST RESULTS TO REDUCE OR ELIMINATE WMSD RISK**

The Physical Job Evaluation Checklist may be used in several ways to help workplaces in their WMSD injury prevention efforts.

1. The Checklist identifies the risk for each WMSD risk factor by level (highest to lowest). This will help workplaces prioritize prevention efforts.
2. The unit of analysis (job, task, activity) of the Checklist is determined by the user, so high risk jobs within a single department or high risk activities within a job may be identified.
3. The Checklist may be used to evaluate work activities that should be avoided for return-to-work or work restriction situations.
4. The Checklist may be used to determine the impact of proposed injury prevention solutions by comparing current exposure levels to potential exposure levels.
5. The Checklist may be used to identify how components of a risk factor (frequency, duration, intensity) may be changed to reduce the risk level. This provides insight into what potential prevention solutions should target.

**Control Strategies**

Once risk factors are identified and level of risk is determined, strategies should be identified to reduce or eliminate exposure to the WMSD risk factor. There are different types of risk factor controls:

1. **Engineering Controls**
   
   Physical changes are made to the workplace, eliminating or reducing the magnitude, frequency and/or duration of the risk factors.
   
   - This is the most desirable control strategy.
   - Examples include installing a machine to do the work, changing processes so the risk factor is no longer present, using a tool to reduce risk factor exposure when performing the work.

2. **Administrative Controls**

   Changes are made in the way work is assigned or scheduled, reducing the magnitude, frequency or duration of exposure.
   
   - Examples include job rotation and job enlargement.

3. **Work Practice Controls**

   This may include training workers on the best ways of performing a job without creating risk factors such as awkward postures.

4. **Personal Protective Equipment (PPE)**

   Equipment is worn by workers to minimize exposure to risk factors that lead to WMSDs.
   
   - This will reduce the magnitude of exposure but not the frequency or duration of exposure.
   - Examples include vibration dampening gloves, impact reducing gloves, anti-fatigue matting, anti-fatigue insoles.
Carefully consider prevention efforts to ensure that implementing changes to eliminate or reduce exposure to one risk factor does not create or increase exposure to another risk factor or to another body part.

LIMITATIONS OF THE PHYSICAL JOB EVALUATION CHECKLIST

In the current version of the Physical Job Evaluation Checklist there are several limitations:

1. The Physical Job Evaluation Checklist DOES NOT predict the occurrence of a WMSD.

2. The Physical Job Evaluation Checklist does not provide suggestions, solutions or industry best practices to reduce or eliminate the presence of WMSD risk factors.

3. The exposure data for this industry, from which the checklist was developed, were collected from observed jobs in a limited number of industry sub-groups. Jobs in other unobserved industry sub-groups may have different exposures that may complicate the job evaluation.

4. At this time, the data in the electronic form cannot be saved. Electronic data entry must be completed in one sitting.
THE ELECTRONIC PHYSICAL JOB EVALUATION CHECKLIST

- The Basics -
The Home Page

The checklists for all industries are included in one file. The Home Page allows the user to select the appropriate industry for the work being performed and to access the paper and electronic data entry forms.

After downloading the Physical Job Evaluation Checklist and opening the file:

1. Click on the SELECT INDUSTRY button and choose your industry. The selected industry will be displayed in the banner below the Home Page title.
2. Print the paper form by clicking on the PRINT PAPER FORM button

3. After recording the exposure data on the paper form, return to this page and click on LAUNCH CHECKLIST to enter the data into the electronic form.
The Tutorial

After clicking on the LAUNCH CHECKLIST button, a tutorial will guide the user through the various features of the checklist, including:

- Navigation through the checklist.
- The tabs across the top of the page.
- The functionality of the buttons on the bottom of each checklist tab page.
- Descriptions of the different features of the checklist that ensure that all necessary data are entered in order to determine a risk level.

To by-pass the tutorial, simply click on the JUST ENTER DATA button. You can exit the tutorial at any point by clicking the ENTER DATA button.
The Results Report

The Report Page is where the results of the job risk evaluation are presented.

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**Manual Material Handling Limits**
- Lifting limit (Not applicable, or insufficient data provided)
- Based on the data entered, CARRYING objects weighing 30.8 lbs. or more will pose a high risk.
- Based on the data entered, PUSHING/PULLING objects with a force of 37.4 lbs. or more will pose a high risk.

**Overall Work Environment**
- Pace of Work poses a moderate risk for developing musculoskeletal disorders.
- Work-related stress poses a low risk for developing musculoskeletal disorders.

**Back**
- Back posture poses a high risk of injury.
- Lifting poses a low risk of injury.
- Pushing/Pulling poses a low risk of injury.
- Whole body vibration poses a low risk of injury.
- Carrying poses a low risk of injury.

**Shoulder**
- Shoulder posture poses a high risk of injury.
- Neck posture poses a high risk of injury.
- Lifting poses a low risk of injury.
- Pushing/Pulling poses a low risk of injury.
- Carrying poses a low risk of injury.

**Hand/Wrist**
- Pinch gripping poses a moderate risk of injury.
- Power gripping poses a moderate risk of injury.
- Hand exertion poses a moderate risk of injury.
- Typing/keying poses a low risk of injury.
- Hand-arm vibration poses a low risk of injury.

**Knee**
- Kneeling poses a low risk of injury.
- Squatting poses a low risk of injury.

---

Learn more about WMSDs at the SHARP website
Give your feedback and help us improve
The Report Page has three parts:

1. Page 1: Evaluation of risk levels for each risk factor, based on the data entered. Risk factors are grouped by body part.

2. Page 2: Summary of all the exposure data entered that was used to determine risk levels.

3. Page 3: All notes that were inputted during data entry.

Results Report - Page 1

Manual Material Handling Limits

1. This section displays the maximum weight limit, based on the data entered. Manual handling more than this weight limit poses a high risk of injury.

2. A maximum weight limit of 0.0001 lbs signifies that there is no safe weight limit established based on the data entered.

Overall Environment, Back, Shoulder, Hand/Wrist, Knee Sections

1) These sections display the level of risk posed by different WMSD risk factors to specific body areas (back, shoulder, hand/wrist, and knee).

2) The level of risk is highlighted by a different color
   - Green: Low risk
   - Orange: Moderate risk
   - Red: High risk

3) Within each section, the risk factors are presented from highest to lowest risk. This can help you prioritize injury prevention efforts.

4) “Insufficient Data/Not Applicable”: This means that either no data are entered for this risk factor (it is not applicable to the work analyzed) or exposure data necessary to determine risk levels are missing.
Page 2 displays the exposure data that was entered into the electronic form. Sections that are not applicable to a specific industry will stay blank.

### Physical Job Evaluation DATA

This page contains all the data used in the calculations which generated the above report.

<table>
<thead>
<tr>
<th>Observation</th>
<th>Made By: SHARP Program</th>
<th>Date: 4/11/2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work Description</td>
<td>Cleaning a house</td>
<td></td>
</tr>
<tr>
<td>Work Duration</td>
<td>More than 4 hours per day</td>
<td></td>
</tr>
<tr>
<td>Max Weight Handled</td>
<td>Heavy (23 to 44 lbs)</td>
<td></td>
</tr>
<tr>
<td>Pace of Work</td>
<td>Sometimes difficult to keep up</td>
<td></td>
</tr>
<tr>
<td>Stress</td>
<td>Not as stressful</td>
<td></td>
</tr>
<tr>
<td>Back Position</td>
<td>When lifting, carrying, or pushing or pulling; infrequently moving (3 times per minute or less)</td>
<td></td>
</tr>
<tr>
<td>Back Activity</td>
<td>Exertions/flex, twisted, or bent to the side</td>
<td></td>
</tr>
<tr>
<td>Hand Position</td>
<td>At or above shoulder height</td>
<td></td>
</tr>
<tr>
<td>Shoulder Movements</td>
<td>Frequent (regular movement)</td>
<td></td>
</tr>
<tr>
<td>Neck Bending</td>
<td>Yes, occasionally</td>
<td></td>
</tr>
<tr>
<td>Visual Demand</td>
<td>Low (almost no need to use fine detail)</td>
<td></td>
</tr>
<tr>
<td>Squatting</td>
<td>None, or less than 2 hours per day</td>
<td></td>
</tr>
<tr>
<td>Kneeling</td>
<td>None, or less than 2 hours per day</td>
<td></td>
</tr>
<tr>
<td>Hand Endotions</td>
<td>Scrubbing bathubs</td>
<td></td>
</tr>
<tr>
<td>Daily Duration</td>
<td>&gt;10 hours/day</td>
<td></td>
</tr>
<tr>
<td>Speed</td>
<td>Fair normal speed of motion</td>
<td></td>
</tr>
<tr>
<td>Frequency</td>
<td>1-2 times per minute</td>
<td></td>
</tr>
<tr>
<td>Erection Duration</td>
<td>30-45% of the time</td>
<td></td>
</tr>
<tr>
<td>Force</td>
<td>Somewhat hard, noticeable or definite effort</td>
<td></td>
</tr>
<tr>
<td>Posture</td>
<td>Bad marked waist bending</td>
<td></td>
</tr>
<tr>
<td>Intensive Keyping</td>
<td>No, does not involve intensive typing or keying</td>
<td></td>
</tr>
<tr>
<td>Typing Duration</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Typing Wrist Posture</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Pinch Grip Duration</td>
<td>2.5 hours total per day</td>
<td></td>
</tr>
<tr>
<td>Additional Risk Factors</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Power Grip Duration</td>
<td>3 hours total per day</td>
<td></td>
</tr>
<tr>
<td>Additional Risk Factors</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Lifting &gt; 75 lb.</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Lifting &gt; 55 lb.</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Frequent Lifting</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Awkward Lifting</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Lifting Activity</td>
<td>Vaguely Lifted</td>
<td></td>
</tr>
<tr>
<td>Weight Lifted</td>
<td>Duration</td>
<td></td>
</tr>
<tr>
<td>Twisting</td>
<td>Frequency</td>
<td></td>
</tr>
<tr>
<td>Frequency</td>
<td>Frequency</td>
<td></td>
</tr>
<tr>
<td>Carrying Activity</td>
<td>Bags of travel</td>
<td></td>
</tr>
<tr>
<td>Maximum Weight</td>
<td>25 lbs.</td>
<td></td>
</tr>
<tr>
<td>Distance</td>
<td>&gt;14 feet</td>
<td></td>
</tr>
<tr>
<td>Elbow Posture</td>
<td>Elbowes bent</td>
<td></td>
</tr>
<tr>
<td>Frequency</td>
<td>Once every 30 minutes</td>
<td></td>
</tr>
<tr>
<td>Push/Pull Activity</td>
<td>Vacuum</td>
<td></td>
</tr>
<tr>
<td>Effort Type</td>
<td>Push and Pull</td>
<td></td>
</tr>
<tr>
<td>Maximum Forceful</td>
<td>20 lbs.</td>
<td></td>
</tr>
<tr>
<td>Distance</td>
<td>&gt;150 feet</td>
<td></td>
</tr>
<tr>
<td>Hand Height</td>
<td>Hip</td>
<td></td>
</tr>
<tr>
<td>Frequency</td>
<td>10 minutes</td>
<td></td>
</tr>
<tr>
<td>Vibrating Hand Tools</td>
<td>Less than 1 hour per day, or Never</td>
<td></td>
</tr>
<tr>
<td>Whole Body Vibration</td>
<td>Less than 2 hours per day</td>
<td></td>
</tr>
</tbody>
</table>

**Total Vibration:**
Page 3 displays any notations that are typed into the electronic form.

Headings are automatically created to keep notes separated by the sections of the electronic form.

<table>
<thead>
<tr>
<th>JOB BASICS:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Job Basics 1</td>
</tr>
<tr>
<td>• Job Basics 2</td>
</tr>
<tr>
<td>BACK:</td>
</tr>
<tr>
<td>• Back 1</td>
</tr>
<tr>
<td>• Back 2</td>
</tr>
<tr>
<td>SHOULDER:</td>
</tr>
<tr>
<td>• Shoulder 1</td>
</tr>
<tr>
<td>• Shoulder 2</td>
</tr>
<tr>
<td>NECK:</td>
</tr>
<tr>
<td>• Neck 1</td>
</tr>
<tr>
<td>• Neck 2</td>
</tr>
<tr>
<td>WORK POSTURES:</td>
</tr>
<tr>
<td>• Lower Limbs 1</td>
</tr>
<tr>
<td>• Lower Limbs 2</td>
</tr>
<tr>
<td>HAND EXERTIONS:</td>
</tr>
<tr>
<td>• Hand Exertions 1</td>
</tr>
<tr>
<td>• Hand Exertions 2</td>
</tr>
<tr>
<td>REPETITION - HAND:</td>
</tr>
<tr>
<td>• Hand Repetition 1</td>
</tr>
<tr>
<td>• Hand Repetition 2</td>
</tr>
<tr>
<td>GRIPPING:</td>
</tr>
<tr>
<td>• Hand Grip 1</td>
</tr>
<tr>
<td>• Hand Grip 2</td>
</tr>
<tr>
<td>MODERATE RISK LIFTING:</td>
</tr>
<tr>
<td>• Lifting 1</td>
</tr>
<tr>
<td>• Lifting 2</td>
</tr>
<tr>
<td>HIGH RISK LIFTING:</td>
</tr>
<tr>
<td>• Heavy Lifting 1</td>
</tr>
<tr>
<td>• Heavy Lifting 2</td>
</tr>
<tr>
<td>CARRYING:</td>
</tr>
<tr>
<td>• Carrying 1</td>
</tr>
<tr>
<td>• Carrying 2</td>
</tr>
<tr>
<td>PUSHING/PULLING:</td>
</tr>
<tr>
<td>• Push/Pull 1</td>
</tr>
<tr>
<td>• Push/Pull 2</td>
</tr>
</tbody>
</table>
INTERPRETING CHECKLIST QUESTIONS
Job Basics

- An evaluation can look at an activity within a task, a task within a job or the entire job. In this checklist we refer to any unit of analysis as “the work”.

General Measurement Guidelines

1. **Work Description**: Describes the work (job, task, or activity) to be evaluated for risk of injury, also called the unit of analysis. This can be any description determined by the user.
   - The unit of analysis (the segment of work evaluated for WMSD risk) is determined by the user.

2. **Work Duration**: The amount of time per day the worker spends performing the work (job/activity/task) being assessed.

3. **Maximum Weight Handled**: The worker’s perception of the weight of the load specifically borne by the worker, not the actual weight being handled.
   - The actual weight is only used as a supplement but not as a replacement for the worker’s assessment.

4. **Pace of Work**: Rates how difficult it is for the worker to keep up with the work.
   - Responses are based on the worker’s perception.
   - The evaluation can be based on the physical difficulty or the self-imposed expectations of the worker in managing the workload.

5. **Work-Related Stress**: Rates the level of work-related stress felt by the worker. Studies have shown that:
   - Work-related stress is an important factor in the development of WMSDs (Bongers et al, 2002).
   - A worker’s subjective assessment of a potential risk factor is considered crucially important (Rydstedt et al, 2004).

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Risk Levels Based on Calculated Scores</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
</tr>
<tr>
<td>Pace of Work</td>
<td>1</td>
</tr>
<tr>
<td>Stress</td>
<td>1</td>
</tr>
</tbody>
</table>

21
The Back

- These questions assess the posture of the lower back for the risk of injury.
- The evaluation is performed when the back is most heavily loaded (most extreme posture).

General Measurement Guidelines

- **Back Position** *(Figure One)*: In addition to flexion (back is bent forward), twisting and side bending should also be considered.

1. **Back Activity**: Back activity is divided into static and dynamic activities.
   - **Static back activity**: Bent or twisted back positions that are held over time.
   - **Dynamic back activity**: Bending or twisting the back (constant motion) when performing manual material handling activities, such as lifting, pushing/pulling or carrying.

Risk Level Definitions

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Risk Levels Based on Calculated Scores</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
</tr>
<tr>
<td>Static Back Postures</td>
<td>8-14</td>
</tr>
<tr>
<td>Dynamic Back Postures</td>
<td>10-20</td>
</tr>
</tbody>
</table>

Checklist Definitions

**Back Posture** *(Figure One)*:

- **Almost Neutral Back Posture**: 0-20° of flexion, twisting, or side bending.
- **Moderately Flexed, Twisted or Side Bent Back Posture**: 21-60° of flexion, twisting, or side bending.
- **Excessively Flexed or Twisted or Side Bent Back Posture**: >60° of flexion, twisting, or side bending.

**Back Movement**:

- **Infrequent Back Movement**: In the range of 1-5 movements per movement (mid-point: 3 times/minute or less).
- **Frequent Back Movement**: In the range of 6-10 movements per minute (mid-point: 8 times/minute).
- **Very Frequent Movement**: More than 10 movements per minute (around 12x/minute or more).
Figure One. Back Flexion Postures

- Back Flexion, 20°
- Back Flexion, 60°
- Lateral Flexion, 20°
Lower Extremities (Kneeling, Squatting)

- Many disorders of the knee occur through the direct compression of the body tissues.
- Studies have shown a link between kneeling and/or squatting and low back disorders.
- Knee disorders are associated with squatting and with heavy physical work.
- Prolonged kneeling may cause reduced blood flow to the lower extremities

Checklist Definitions

Kneeling: Supporting the body weight on either one or both knees.

Squatting: Crouching with the knees bend and the heels close to or touching the buttocks of the back of thighs.

Risk Level Definitions

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Risk Levels Based on Daily Duration of Exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
</tr>
<tr>
<td>Kneeling</td>
<td>≤ 2 hours</td>
</tr>
<tr>
<td>Squatting</td>
<td>≤ 2 hours</td>
</tr>
</tbody>
</table>
The Shoulder

- Shoulder elevation is a risk factor for WMSDs in the shoulder.
- The load on the muscles of the shoulder increases as the arms are raised higher.
- The risk of shoulder WMSDs is assessed when the shoulders/arms are most heavily loaded (most extreme posture).

General Measurement Guidelines

1. **Hand Position:** Shoulder posture is based on the position of the hands.
   - The worst or most extreme posture should be chosen.

2. **Shoulder Movements:** Consider any continuous movement of the shoulder, not just repetitive, cyclical actions.
   - Based on the worker’s perceptions about the movement pattern of the shoulder, not the number of movements within a given period of time.

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Risk Levels Based on Calculated Scores</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
</tr>
<tr>
<td>Awkward Shoulder Postures</td>
<td>10-20</td>
</tr>
</tbody>
</table>

Risk Level Definitions

**Checklist Definitions**

**Shoulder Postures:** Non-neutral postures, where arms are elevated away from the sides of the body. Consider shoulder elevation in all planes (Figure Two).

**Static Shoulder Postures (static loading):** Physical exertions in which the same posture or position is held throughout the exertion.

**Dynamic Shoulder postures:** Physical exertions created by the movement of the shoulder.
Figure Two. Shoulder Postures:

Shoulder Abduction

Shoulder Flexion
The Neck

- Non-neutral neck postures held for prolonged periods of time are a risk for neck and/or shoulder problems.

General Measurement Guidelines

1. **Neck Bending**: Considers any non-neutral neck posture.
   - Flexion – head bent forward, chin pointed down.
   - Extension – head bent back, chin pointed up.
   - Twisted – head turned to the side.

2. **Visual demands**: Can impact the degree the neck is bent forward.
   - Based on the worker’s perceptions, not the checklist user’s perceptions.

### Risk Level Definitions

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Risk Levels Based on Calculated Scores</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
</tr>
<tr>
<td>Awkward Neck Postures</td>
<td>4-6</td>
</tr>
</tbody>
</table>

**Checklist Definitions:**

**Non-neutral posture**: Neck angle >20° relative to the torso.

Neck Flexion, 20°

Neutral Neck Position

Neck Extension, 20°
Hand Exertions

- These questions assess the risk of WMSDs of the hand, wrist and elbow from the activity of the hands.
- You may assess only one type of hand exertions or all hand exertions collectively.
- Considers several factors that contribute to risk:
  - The duration that the hand activities occur.
  - The speed at which the hands must exert force.
  - The frequency at which hand exertions are performed.
  - Duration of the actual hand exertions.
  - The level of force exerted by the hands.
  - The posture of the wrist when the hand exertions are performed.

General Measurement Guidelines

1. **Duration of Task per Day:** The total time the work is performed per day.
   - Expressed in hours.

2. **Speed of Work:** Indicates the perceived pace of the work performed.
   - Determined by the checklist user.
   - Imposes a modifying effect on exertion.

3. **Frequency:** Reflects the repetitiveness of the hand exertions.
   - The number of hand exertions that occurs during an observation period.
   - The observation period may be the duration of an activity, multiple activities, a task or the entire day.

4. **Duration of Exertion:** Estimates how long hand efforts/exertions are held over a period of time.
   - Also referred to as duty cycle.
   - Expressed as a percentage of time spent performing hand exertions during an observation period.
5. **Hand Force:** Estimates the hand force applied during the exertions/efforts.
   - Reflects the muscular effort required.
   - This is the most critical aspect of hand activity to consider – increasing levels of muscular effort implies increasing levels of strain on the hand, wrist and elbow.

6. **Hand/Wrist Posture:** Characterizes the deviation of the wrist from the anatomical neutral posture.
   - Posture is determined qualitatively, not quantitatively.
   - Able to use the most common, the average or the most extreme wrist posture.
   - Choosing the most extreme wrist posture will result in the most protective evaluation.

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Risk Levels Based on Calculated Scores</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
</tr>
<tr>
<td>Hand Exertions</td>
<td>≤ 3</td>
</tr>
</tbody>
</table>

**Checklist Definitions**

**Speed of Work:**
- Very fast: The observed worker(s) either does not or barely manages to keep up with the required pace of the job, usually associated with relatively high rating for efforts per minute.
- Fast: Worker(s) are not overtly rushed but rely on deliberate action, also likely to have high efforts-per-minute ratings.

**Frequency:** Expressed as the number of hand efforts per minute.

\[
\text{Efforts per minute} = \frac{\text{number of exertions}}{\text{Total observation time}}
\]
**Duration of Exertion**

- **Hand Exertion:** When the hand force is first applied to when the hand force is released; can include pinching, gripping, squeezing, cutting, and pressing.
- **Duration of Exertion:** The duration of all exertions during an observation period divided by the total time of the observation period.

\[
\%\text{Duration of exertion} = \frac{\text{duration of all exertions}}{\text{Total observation time}} \times 100
\]

**Hand/Wrist Posture**

- **Neutral Wrist Posture**
Hand Repetition – Intensive Keying

- These questions evaluate the risk of hand/wrist WMSDs from intensive keying or prolonged data entry – prolonged, continuous data entry or keying activities.
- The risk of injury is increased when intensive keying is combined with awkward wrist postures.

Checklist Definitions

Awkward wrist postures (Figure Three):
- Wrist flexion: Bending the wrist 30° so that the palm moves closer to the wrist.
- Wrist extension: Bending the wrist 45° so that the top of the hand moves towards the forearm.
- Ulnar deviation: Bending the wrist sideways 30°, moving the little finger towards the forearm.

Risk Level Definitions

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Risk Levels Based on Daily Duration of Exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intensive Keying</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>≤ 4 hours</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure Three. Awkward Wrist Postures

- Wrist Flexion 30°
- Wrist Extension 45°
- Wrist Ulnar Deviation 30°
Hand Gripping – Pinch Grip

- The questions evaluate the risk of hand/wrist WMSDs from handling objects with a pinch grip.

General Measurement Guidelines:

1. Considers the risk of injury from the hand force generated by supporting the full weight of an object with the fingertips of ONE hand.
2. The evaluation is triggered when an object, either weighing 2 or more pounds or gripped with a force of $\geq 4$ pounds, is held.
3. Four pounds of hand force is approximately equivalent to:
   - Pinching a clothespin open.
   - Holding a half ream of paper with a pinch grip.

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Risk Levels Based on Daily Duration of Exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Hand Force</td>
<td>Low $\leq 2$ hours</td>
</tr>
<tr>
<td>Pinch Gripping</td>
<td>Moderate $&gt; 2$ hours</td>
</tr>
<tr>
<td></td>
<td>High $&gt; 3$ hours PLUS Awkward wrist postures</td>
</tr>
<tr>
<td></td>
<td>$&gt; 3$ hours PLUS Highly Repetitive Hand/Wrist motions</td>
</tr>
<tr>
<td></td>
<td>$&gt; 4$ hours with no other risk factors</td>
</tr>
</tbody>
</table>

Checklist Definitions

Pinch grip: Holding an unsupported object with the fingertips of ONE HAND.
- See Figure Four for examples of pinch grips.

Highly repetitive motions: Using the same motion in the wrist with little or no variation every few seconds.

Awkward Wrist Postures (Figure Five)
- Wrist flexion: Bending the wrist 30° so that the palm moves closer to the wrist.
- Wrist extension: Bending the wrist 45° so that the top of the hand moves towards the forearm.
- Ulnar deviation: Bending the wrist sideways 30°, moving the little finger towards the forearm.
Figure Four. Examples of Pinch Gripping

Not considered pinching: Hook Grips
Figure Five. Awkward Wrist Postures

- Wrist Flexion 30°
- Wrist Ulnar Deviation 30°
- Wrist Extension 45°
Hand Gripping – Power Grip

- The questions evaluate the risk of hand/wrist WMSDs from handling objects with a power grip.

General Measurement Guidelines:

1. Considers the risk of injury from the hand force generated by supporting the full weight of an object with the fingers of ONE hand.

2. The evaluation is triggered when an object, either weighing 10 or more pounds or gripped with a force of $\geq 10$ pounds, is held.

3. Ten pounds of hand force is comparable to clamping a light duty automotive jumper cable onto a battery.

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Risk Levels Based on Daily Duration of Exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>High Hand Force – Power Gripping</strong></td>
<td>Low $\leq$ 2 hours   Moderate $&gt; 2$ hours    High $&gt;3$ hours PLUS Awkward wrist postures $&gt;3$ hours PLUS Highly Repetitive Hand/Wrist motions $&gt; 4$ hours with no other risk factors</td>
</tr>
</tbody>
</table>

Checklist Definitions

**Power grip:** Holding an unsupported object in the palm of ONE HAND with the fingers wrapped around.

- See [Figure Six](#) for examples of Power Gripping.

**Highly repetitive motions:** Using the same motion in the wrist with little or no variation every few seconds.

**Awkward wrist postures** ([Figure Five](#))

- Wrist flexion: Bending the wrist $30^\circ$ so that the palm moves closer to the wrist.
- Wrist extension: Bending the wrist $45^\circ$ so that the top of the hand moves towards the forearm.
- Ulnar deviation: Bending the wrist sideways $30^\circ$, moving the little finger towards the forearm.
Figure Six. Examples of Power Gripping

Not considered Power Gripping: Hook Grips
Manual Material Handling – Moderate and High Risk Lifting

- Relates to the movement of an object, where the object’s weight is supported by a worker(s) from a point of origin to a destination.

General Measurement Guidelines

1. Moderate and high risk lifting are determined in two separate checklist pages. Moderate risk is assessed first on the Moderate Risk Lifting page. If moderate risk lifting exists, then high risk lifting is determined on the High Risk Lifting page.

2. High risk lifting is present when the actual weight handled is more than the calculated weight limit (based on frequency, duration and twisting of the torso).

3. If lifting conditions do not present a high risk, i.e. the actual weight handled is less than the calculated weight limit, moderate risk will remain AS LONG as any lifting condition for moderate risk is present.

4. The determination of the risk level does not account for lowering actions.

5. If the weight is unknown, a simple scale or spring scale can be used to determine the weight.

6. When 2 or more workers lift an object (team lifting), the weight supported by any one worker is the total weight of the object divided by the number of workers performing the lift.

7. If the work involves lifts of different weights and/or from different locations (i.e. unloading pallets), determine risk by:
   - Analyzing the two worst-case lifts – the heaviest lift and the lift done in the most awkward posture.
   - Analyzing the most commonly performed lift, however use the frequency and duration for ALL lifting done in a typical day.

8. The evaluation considers several factors that contribute to the risk of manually lifting:
   - **Hand Height:** Assumes the worker is standing erect with arms hanging at his/her sides.
- **Duration of lifting:** The total number of hours actually performing the lifts, not the time spent in the job where lifting occurs.
  - Choose the option that is closest to the determined duration.
- **Frequency of lifting:** Considers how often a lift is performed.
  - Choose the option that is closest to the estimated frequency
- **Twisting:** Considers the twisting of the torso in the sagittal plane.

### Risk Level Definitions

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Risk Levels Based on Maximum Weight Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
</tr>
<tr>
<td>Manual Lifting</td>
<td>Heavy Lifting:</td>
</tr>
<tr>
<td></td>
<td>Lifting &gt;75 lbs at least once <strong>OR</strong></td>
</tr>
<tr>
<td></td>
<td>Heavy Lifting:</td>
</tr>
<tr>
<td></td>
<td>Lifting &gt;55 lbs, 10 times per day <strong>OR</strong></td>
</tr>
<tr>
<td></td>
<td>Frequent Lifting:</td>
</tr>
<tr>
<td></td>
<td>Lifting &gt;10 lbs, 2X/minute, for 2 hours per day <strong>OR</strong></td>
</tr>
<tr>
<td></td>
<td>Awkward Lifting:</td>
</tr>
<tr>
<td></td>
<td>Lifting &gt;25lbs more than 25 X above shoulders, below knees, at arms’ length’</td>
</tr>
<tr>
<td></td>
<td>High</td>
</tr>
<tr>
<td></td>
<td>Actual weight lifted &gt; lifting limit</td>
</tr>
</tbody>
</table>

### Checklist Definitions

**Position of the Hands:** The location of the hands in relation to the body at the start of the lift.

**Frequency of Lifting:** Expressed in # of lifts/minute.

**Twisting:** While lifting, twisting the torso ≥45° in the sagittal plane.
The questions collect data used to help estimate the portion of the population that would find the carrying demands acceptable as a regular part of daily work.

Risk levels coincide with the percentage of the portion of the population who would find the carrying demand acceptable.
- The greater the percent acceptable, the lower the presumed risk.

Risk levels for carrying were determined using the tables created by Thomas E. Bernard of the University of South Florida, using data obtained from tables created by SH Snook and VM Ciriello (1991)\(^6\), commonly referred to as the Snook and Ciriello Tables. [http://personal.health.usf.edu/tbernard/ergotools/]

Carrying analysis is an adaption of the guidance developed by the Liberty Mutual Insurance Company.

**General Measurement Guidelines**

1. To be the most protective, the most extreme carrying activity should be used in the risk determination.

2. If various loads are carried, different approaches may be used to determine the exposure.
   - Use the characteristics of the most common carry (most common weight, most common distance carried).
   - Use the most extreme case (heaviest weight, longest distance carried).

3. The evaluation should not be used to determine the risk from catching or throwing items.

### Risk Level Definitions

Risk levels are based on the proportion of the population that should be able to do this activity.

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Risk Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
</tr>
<tr>
<td>Carrying</td>
<td>≥ 75% of women</td>
</tr>
<tr>
<td></td>
<td>Moderate</td>
</tr>
<tr>
<td>Carrying</td>
<td>50% - 75% of women</td>
</tr>
<tr>
<td></td>
<td>High</td>
</tr>
<tr>
<td>Carrying</td>
<td>≤ 50% of women</td>
</tr>
</tbody>
</table>
Checklist Definitions

**Weight**: Weight of the objects being carried.

**Distance**: The distance the item is carried with its weight fully supported by the worker.

**Frequency**: The number of carries performed in a specified period of time.
The questions collect data used to help estimate the portion of the population that would find the pushing/pulling demands acceptable as a regular part of daily work.

The analyses for this evaluation estimates the portion of the population who would find the push or pull demands acceptable.

- The greater the percent acceptable, the lower the presumed risk.

Risk levels for pushing and pulling were determined using the tables created by Thomas E. Bernard of the University of South Florida [http://personal.health.usf.edu/tbernard/ergotools/](http://personal.health.usf.edu/tbernard/ergotools/).

The Bernard Push/Pull analyses is an adaption of the guidance developed by the Liberty Mutual Insurance Company. Analysis uses data obtained from tables created by SH Snook and VM Ciriello (1991)\(^6\), which are commonly referred to as the Snook and Ciriello Tables.

The level of risk from pushing or pulling is determined using the initial force only – the force required to overcome inertia and start the object in motion.

- Application of sustained push/pull forces (the force required to keep the object in motion) is not considered.

From the Bernard tables, only the recommendations from the Snook and Ciriello initial force values were considered in the determination of risk level

**General Measurement Guidelines**

1. Measurement requires a spring scale, load cell or other force measure device to measure push or pull forces.

2. There are different methods to determine push/pull forces. To be the most protective, the maximum force value should be used in the risk determination.

3. Taking more than one measurement is recommended.

4. When both push and pull forces are indicated, the checklist chooses the force that produces the highest risk.

5. Consideration of only initial push/pull forces was chosen because:
• The initial force is most often high than the sustained force.
• The measurement of the initial force is more easily measured using simple tools, while measurement of sustained forces requires more sophisticated instrumentation.

6. If push/pull forces occur in different areas of the work space, approaches to determine the push/pull forces include:
   • Measure push/pull forces in the different work areas and accept the maximum.
   • Measure push/pull forces in the different areas and accept the average.

7. If there are a variety of different loads, approaches to determine the push/pull forces includes:
   • Measure force for a variety of loads and accept the maximum.
   • Measure force for a variety of loads and accept the average.
   • Measure the force for the most common.

8. If multiple mechanical tools are used, approaches to determine push/pull forces include:
   • Measure the force for each and accept the maximum.
   • Measure the force for each and accept the average.
   • Measure the force for the most commonly used.

### Risk Level Definitions
Risk levels are based on the proportion of the population that should be able to do the activity.

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Risk Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pushing</td>
<td>Low: ( \geq 75% \text{ of women} )</td>
</tr>
<tr>
<td>Pulling</td>
<td>Low: ( \geq 75% \text{ of women} )</td>
</tr>
</tbody>
</table>

### Checklist Definitions

**Pushing:** A force directed away from the body and involves forward walking; using a person’s physical ability to move an object across a surface between 2 points.

**Pulling:** A force directed towards the body and involves either forward or backwards walking; using a person’s physical ability to move an object across a surface between 2 points.
Hand/Arm Vibration

- This question quantifies the hand/arm vibration that occurs from the use of vibrating hand tools.

General Measurement Guidelines

1. Hand/Arm vibration, also known as segmental vibration, can be caused by operating hand-held power tools, hand-guided machinery or by hand-fed machines.

2. This evaluation is based on the duration of exposure.

3. The duration of exposure is estimated by the worker.

4. The level of vibration not considered in evaluation.

5. The evaluation can involve one tool or all tools used during the analysis period.

6. Damaged, improperly maintained or old equipment may have vibration levels higher than manufacturer’s specifications.

<table>
<thead>
<tr>
<th>Risk Level Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk Factor</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Hand/Arm Vibration</td>
</tr>
</tbody>
</table>
Whole Body Vibration

- These questions determine the level of vibration the body is exposed to.

General Measurement Guidelines

1. Whole body vibration is transmitted through the seat (such as a vehicle seat) or the feet.

2. Vibration levels can be expressed in several different ways:
   - As a single value which represents the vector sum RMS.
   - As three values which represent the magnitude of vibration in three directions (x, y and z axes).

   - Vibration levels can be expressed as either the vector sum or on 3 axes.
   - These three values may be described as Effective Value RMS values or peak values.
   - If there are three values, choose the highest.

Risk Level Definition

Risk levels are based on duration of exposure and total 8-hr Equivalent Vibration (WBV8-hr) Level.

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Risk Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
</tr>
<tr>
<td>Whole Body Vibration</td>
<td>Duration ≤ 2.0 hours</td>
</tr>
</tbody>
</table>

Checklist Definitions

Moderate Risk Level: Determined by the duration frequency distributions when vibration > 0.5 m/s² (EU Vibration Directive Action Limit).

Calculation of Whole Body Vibration level (WBV8-hr), based on 8-hr equivalent:

- For Single vehicle:
  \[ WBV8_{-hr} = \sqrt[8]{\text{exposure duration}/8} \times \text{identified vibration value (m/s}^2\text{)} \]
• For Multiple vehicles:

1) Determine partial vibration level for each vehicle:

\[
\text{Partial vibration (pvib)} = \sqrt{\frac{\text{exposure duration}}{8}} \times \text{identified vibration value (m/s}^2)\]

2) Determine total vibration level for all vehicles:

\[
\text{WBV}_{8-hr} = \sqrt{(pvib_1)^2 + (pvib_2)^2 + (pvib_3)^2 + \ldots} 
\]
REFERENCE LIST


APPENDIX ONE: Services (excluding Public Safety) Physical Job Evaluation Checklist

Items Sources

Washington Caution/Hazard Zone Checklist

- Hand Gripping – Pinch Grip
- Hand Gripping – Power Grip
- Hand Repetition – Intensive Keying
- Hand/Arm Vibration
- Lower Extremities – Kneeling, Squatting
- Manual Material Handling – Lifting
- Whole Body Vibration

Quick Exposure Checklist (QEC)

- Back Postures
- Maximum Weight Handled
- Neck Postures
- Pace of Work
- Shoulder Postures
- Work Duration
- Work-Related Stress

Thomas Bernard Manual Material Handling Tables

- Manual Material Handling – Carry
- Manual Material Handling – Push/Pull

Strain Index

- Hand Exertions
ACKNOWLEDGEMENTS

This document is a product of a research study “Using Workers’ Compensation Data to Identify High Risk Workplaces for Work-Related Musculoskeletal Disorders (WMSDs), which was supported in part by CDC/NIOSH Cooperative Agreement 5 U60 OH 008487.

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Many thanks to Ace Guerra and Amanda Robinson for their amazing assistance with graphics for this report, as well as Jena Williams and Christina Rappin.