MSD Prevention Toolbox

- More on In-depth Risk Assessment Methods

Final (January 14, 2008)

Disclaimer

The material contained in this Toolbox is for information and reference purposes only and not intended as legal or professional advice. The adoption and/or use of the tools, information, and/or practices described in this Toolbox may not meet the needs, requirements or obligations of individual workplaces.

The guidance in this Toolbox does not, in any way, limit or reduce the obligations that workplace parties have under the Occupational Health and Safety Act (R.S.O. 1990, Chapter O.1, as amended), or any of its regulations. The Occupational Health and Safety Act (OHSA) requires employers to provide information, instruction and supervision to workers and to take every precaution reasonable under the circumstances for the protection of workers. Musculoskeletal Disorders (MSD) hazards that are present in the workplace must be recognized and precautions put in place to fulfill requirements under the OHSA.

Workers also have duties under the OHSA, including the duty to use equipment and protective devices provided to them to reduce their MSD risk, and to report defects and hazards of which they are aware to their supervisor. The OHSA also gives workers the right to participate, the right to know, and the right to refuse work that they believe is dangerous to their own health and safety or the health and safety of another worker.

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Acknowledgements

This document, *Part C: MSD Prevention Toolbox – More on In-depth Risk Assessment Methods,* is part of the Occupational Health and Safety Council of Ontario's Musculoskeletal Disorders (MSD) Prevention Series. It was developed in partnership with the members of the Occupational Health and Safety Council of Ontario (OHSCO), with the support of the Centre of Research Expertise for the Prevention of Musculoskeletal Disorders (CRE-MSD), and in consultation with representatives from Ontario's labour organizations, employer associations, and individual employers and workers.

Supporting organizations include:

Construction Safety Association of Ontario

Education Safety Association of Ontario

Electrical & Utilities Safety Association

Farm Safety Association

Industrial Accident Prevention Association

Institute for Work & Health

Mines and Aggregates Safety and Health Association

Municipal Health & Safety Association

Occupational Health Clinics for Ontario Workers

Ontario Forestry Safe Workplace Association

Ontario Ministry of Labour

Ontario Safety Association for Community & Healthcare

Ontario Service Safety Alliance

Pulp and Paper Health and Safety Association

Transportation Health & Safety Association of Ontario

Workers Health & Safety Centre

Workplace Safety & Insurance Board (Ontario)

The support and participation of everyone who contributed to the development of the MSD Prevention Guideline for Ontario and its related documents is greatly appreciated.

Scope of the MSD Prevention Toolbox – More on In-depth Risk Assessment Methods

Part 3C: MSD Prevention Toolbox – More on In-depth Risk Assessment Methods has been made available through the partners of the Ontario Health and Safety system. It is the third document in the three-part Toolbox, which also includes *Part A: MSD Prevention Toolbox - Getting Started* and *Part B: MSD Prevention Toolbox – Beyond the Basics*.

The primary purpose of this document is to provide Ontario workplace parties with additional information on in-depth MSD risk assessment methods. If you are looking for more basic information about MSD prevention and MSD hazards or for MSD hazard identification tools, please see *Part A: MSD Prevention Toolbox - Getting Started*. *Part B: MSD Prevention Toolbox – Beyond the Basics* contains more information to help you enhance your MSD prevention process, and includes an MSD Risk Assessment Checklist.

This document is provided as a support document for the MSD Prevention Guideline for Ontario and the Resource Manual for the MSD Prevention Guideline for Ontario.

The risk assessment methods described in this document may be helpful if the simple risk assessment method, as described in the Resource Manual for the MSD Prevention Guideline for Ontario, has not identified which MSD hazards are of concern or how exposure to them can be controlled. It is understood that there are other risk assessment methods that may be useful depending on the type of work being performed.

There is no requirement for workplaces to use any of the risk assessment methods described in this Toolbox. Workplaces should determine which risk assessment methods, whether they are the ones described in this Toolbox or others, are best able to help them with their MSD prevention efforts.

For more information about MSD Prevention, contact your Health and Safety Association.

Health and Safety Associations	Phone	Website
Construction Safety Association of Ontario	(800) 781-2726	www.csao.org
Education Safety Association of Ontario	(416) 250-8005	www.esao.on.ca
Electrical & Utilities Safety Association	(905)625-0100	www.eusa.on.ca
Farm Safety Association	(800) 361-8855	www.farmsafety.ca
Industrial Accident Prevention Association	(800) 406-4272	www.iapa.on.ca
Mines and Aggregates Safety and Health Association	(705) 474-7233	www.masha.on.ca
Municipal Health & Safety Association	(905) 890-2040	www.mhsao.com
Occupational Health Clinics for Ontario Workers	(416) 510-8713	www.ohcow.on.ca
Ontario Forestry Safe Workplace Association	(705) 474-7233	www.ofswa.on.ca
Ontario Safety Association for Community & Healthcare	(416) 250-7444	www.osach.ca
Ontario Service Safety Alliance	(800) 525-2468	www.ossa.com
Pulp and Paper Health and Safety Association	(705) 474-7233	www.pphsa.on.ca
Transportation Health & Safety Association of Ontario	(800) 263-5016	www.thsao.on.ca
Workers Health & Safety Centre	(416) 441-1939	www.whsc.on.ca

More information, including sector specific materials, can be found on-line at:
http://www.preventionpractices.com/msd.html

Description of Tools and Information in this Toolbox

In-depth MSD Risk Assessment Process Review Tool

This table summarizes the steps involved in an in-depth MSD risk assessment as described in the Resource Manual for the MSD Prevention Guideline for Ontario (pages 40-45). If your workplace is at this stage in the MSD prevention framework, this tool may be useful in helping you to conduct a successful in-depth MSD risk assessment.

Selecting an Appropriate MSD Risk Assessment Method(s)

This tool provides tips on what to consider prior to selecting an appropriate risk assessment tool.

MSD Risk Assessment Methods: Summary Table

This summary table allows you to see which risk assessment methods are appropriate for selected MSD hazards and/or body parts. The table provides examples of commonly used methods that can be completed with little or no equipment. They are freely available on the internet. The table provides guidance on how much time these methods take to complete, the amount of training needed, and the cost of using the method. This table is not a comprehensive list of all available MSD risk assessment methods.

MSD Risk Assessment Methods: Brief Descriptions of Selected Methods

Brief descriptions of a selected group of the MSD risk assessment methods listed in the summary table have been included in this part of the Toolbox. The descriptions include information on the parts of body assessed, where the methods can and should be used (job, task or work setting), MSD hazards considered, a description of the method's process, equipment required, how to interpret the method's results, limitations of the method, where the method was originally published and where to get more information.

Included in this section is a brief description of the MSD Risk Assessment Checklist that is provided in *Part B: MSD Prevention Toolbox – Beyond the Basics*, and some information on 'How to Use the MSD Risk Assessment Checklist' , including tips to make completing the checklist easier, particularly if you do not have access to equipment that many ergonomists use.

It is not possible to provide descriptions and information on all MSD Risk Assessment Methods, including computer-based and software methods and methods developed in-house. Other methods are available and may be useful in a variety of different workplaces and work settings.

In-depth MSD Risk Assessment Process Review Tool

	No	In discussion / development	Yes, partially / sometimes	Yes, fully / always
1. Trained/knowledgeable in-house personnel are available to conduct in-depth MSD risk assessments **or** assistance is obtained from a qualified individual from outside the organization.	☐	☐	☐	☐
2. Appropriate individuals are informed when in-depth risk assessments are required.	☐	☐	☐	☐
3. In-depth risk assessments include a detailed task analysis that includes observations and descriptions of the activities required to complete each task or sub-task, including those that are required during breakdowns, shutdown and start-up and non-routine tasks.	☐	☐	☐	☐
4. Those responsible for conducting in-depth risk assessments are able to select and justify the use of one or more risk assessment methods (e.g. MSD Risk Assessment Checklist, NIOSH Lifting Equation, RULA, QEC, etc.)	☐	☐	☐	☐
5. Appropriate equipment and tools are available to collect the data and information needed for the selected risk assessment methods (e.g. force gauges, weigh scales, digital and video cameras, tape measures, stop watches, goniometers, etc.)	☐	☐	☐	☐
6. The results of in-depth risk assessments are communicated so that they are clearly understood by everyone involved.	☐	☐	☐	☐
7. The results of the in-depth risk assessment are reviewed by appropriate workers, supervisors, managers, and the JHSC/H&S rep.	☐	☐	☐	☐
8. When the results of the in-depth risk assessment indicate that there is an increased risk of MSDs, efforts are made to select and implement MSD hazard controls.	☐	☐	☐	☐
9. If an in-depth risk assessment does not indicate that there is an increased risk but there is a history of MSDs, reports of pain and discomfort, or concerns about task-related physical demands, continued efforts are made to determine the factors that contribute to these issues.	☐	☐	☐	☐
Total number of checkmarks in each column				

Develop an action plan to improve your in-depth risk assessment process. What can be done to increase the number of checks in the 'Yes, fully / always' column?

Note: see *Part B: MSD Prevention Toolbox – Beyond the Basics* for a copy of the MSD Risk Assessment Checklist

Selecting an Appropriate MSD Risk Assessment Method(s)

This tool provides a number of principles to consider when choosing one or more appropriate MSD risk assessment methods.

1) Determine if an in-depth risk assessment is really needed
   - An in-depth risk assessment should be considered if the MSD hazards are not clearly understood, or there is no agreement on the root cause of the hazards.

2) Obtain a detailed understanding of how the job is done and all the tasks and subtasks involved.
   - Work with experienced workers and observe and document all tasks and subtasks including those that are required during breakdowns, shutdown and start-up, and non-routine, but predictable, tasks

3) Ensure that there is agreement on which MSD hazards need to be assessed, the body parts affected, and the tasks or subtasks that should be investigated.

4) Refer to the "MSD Risk Assessment Methods Summary Table" that follows to identify the potential risk assessment methods that meet the criteria agreed upon in Step 3. You may also consider other risk assessment tools that you are familiar with. However, make sure they are from a reliable source and accurately measure the MSD risk.

5) Of the MSD Risk Assessment Methods that meet Step 3 criteria, determine which assessment method(s) your workplace would like to use. You can base your decision on:
   - Whether any in-house staff are trained on how to use and interpret any of the MSD risk assessment methods,
   - Complexity of training required if no in-house staff have the appropriate training,
   - The time required to complete the assessment,
   - Cost associated with using the tool (i.e. equipment required).

Note: In some instances a workplace may find it less costly and efficient to seek help from a qualified person from outside the workplace. See "Things to Consider when Selecting a Person To Help You with MSD Prevention" on pages 46-47 of the *Part A: MSD Prevention Toolbox – Getting Started*.

MSD Risk Assessment Methods Summary Table

	MSD Hazards Assessed							Body Parts Considered							
Assessment Tool	**Repetition / Duration**	**Force: Gripping/ Pinching**	**Force: Lift/ Lower/ Carry**	**Force: Push/ Pull**	**Posture**	**Vibration**	**Contact Stress/ impact**	**Neck/ Shoulder**	**Hand/ Wrist/ Arm**	**Back/ Trunk/ Hip**	**Leg/ Knee/ Ankle**	**Time to Complete**	**Training Required/ Complexity**	**Cost**	**Page #**
Checklist Methods (multiple hazards considered)															
MSD Hazard Risk Assessment Checklist	X	X	X	X	X	X	X	X	X	X	X	MEDIUM	LOW	LOW	6
Washington State Checklists (Caution / Hazard Zone)	X	X	X	X	X	X	X	X	X	X	X	MEDIUM	LOW	LOW	15
Manual Material Handling (lifting, lowering, pushing, pulling, carrying)															
ACGIH: Lifting TLV	X		X		X			X		X		LOW	LOW	LOW	16
NIOSH Lifting Equation	X		X		X			X		X		LOW	LOW	LOW	18
Snook Tables	X		X	X	X			X		X	X	LOW	LOW	LOW	21
MAC (UK)	X		X		X			X		X		LOW	LOW	LOW	24
Mital et al. Tables	X		X	X	X			X		X	X	LOW	MEDIUM	LOW	24
Upper Limb															
ACGIH HAL	X	X	X	X					X			MEDIUM	MEDIUM	HIGH	25
RULA	X				X			X	X	X		LOW	MEDIUM	LOW	27
Strain Index	X	X	X	X	X				X			MEDIUM	MEDIUM	LOW	30
CTD Risk Index (CTD-RAM)	X	X	X	X				X	X			MEDIUM	MEDIUM	HIGH	32
LUBA					X			X	X	X		MEDIUM	MEDIUM	LOW	32
OCRA	X	X	X	X	X	X	X	X	X			MEDIUM	MEDIUM	LOW	32
Combined Methods (not checklist)															
QEC	X		X	X	X	X		X	X	X	X	LOW	MEDIUM	LOW	34
REBA	X		X	X	X			X	X	X	X	LOW	MEDIUM	LOW	37
ManTRA	X	X	X	X	X	X		X	X	X	X	LOW	MEDIUM	LOW	40
OWAS	X	X	X	X	X			X		X	X	HIGH	MEDIUM	LOW	40

Time to Complete: Low: < 2 hours Medium: 2 – 4 hours High: > 4 hours
Training Required: Low: < 4 hours Medium: 4 – 8 hours High: > 8 hours

Cost: Low: equipment recommended, not required
Medium: some equipment required (force/weigh scale)
High: equipment required (video/digital camera, force/weight scale, etc.)

Note: See page 41 for a short description of selected computer-based models for assessing loads on the spine/hand

MSD Risk Assessment Methods
Brief Descriptions of Selected Methods

Brief descriptions of selected MSD risk assessment methods are provided for information purposes only. The risk assessment methods described below are commonly used by ergonomists and others who have knowledge, training and experience to use these methods.

The descriptions provide a basic overview of each method, with a brief description of the steps required to use the method and the type of data that needs to be collected.

It is expected that this information will be of most use to those individuals who have some training in MSD risk assessment methods, and are interested in finding out more about a specific method they may have heard about and are considering using.

Information on where to get more detailed information about each method is also provided.

It is strongly recommended that individuals receive advice and training from a qualified person before using any of the methods described below. It is suggested you read 'Things to Consider when Selecting a Person to Help You with MSD Prevention', that can be found on pages 46-47 of *Part A: MSD Prevention Toolbox – Getting Started*.

Methods Described: **Page**

Checklist Risk Assessment Methods

MSD Risk Assessment Checklist

The MSD Risk Assessment Checklist helps you to look for and identify specific job/task demands that research suggests can lead to an increased risk of developing MSD hazards. The checklist was modified from the Caution Zone Checklist developed by the Washington State (U.S.) Department of Labor and Industries (see below). As with any checklist, this checklist has some limitations. It only looks at a specific set of MSD hazards and job/task demands, so some of the less common hazards that may be contributing to MSDs may not be captured with this checklist. It also does not identify how MSD hazards interact with each other to increase the risk of MSDs. In addition, as with all checklists of this type, the values on the checklist indicate that there is an increased risk of injury but this does not mean that all workers performing jobs at or above these levels will develop an MSD. Finally, this checklist may not be suitable for assessing MSD risk in all types of jobs; namely jobs with a great deal of variability during the day, or jobs that involve moving people or animals.

A copy of this checklist can be found in *Part B: MSD Prevention Toolbox – Beyond the Basics*. Information on how to use the MSD Risk Assessment Checklist can be found on pages 7 - 14.

How to Use the MSD Risk Assessment Checklist

The MSD Risk Assessment Checklist can be found in *Part B: MSD Prevention Toolbox – Beyond the Basics*. This document provides a detailed explanation on how to use the checklist.

Remember – It is not possible to include all hazards or workplace factors that can contribute to the development of MSDs on one checklist. If workers are reporting pain or discomfort that they associate with a work-related activity, but the MSD Risk Assessment Checklist does not indicate an increased level of risk, a more specific or detailed risk assessment method may be needed.

Using the MSD Risk Assessment Checklist

1) **Document** the job title, activity, date and name of persons(s) completing the worksheet.
2) **Observe** a sample of workers who are performing the activity.
3) **Take notes** on the activity and the physical demands required (e.g. weights, forces, postures, motions/movements).
4) **Compare** observations and notes with the criteria on the MSD Risk Assessment Checklist.
5) **Draw conclusions:**
   a. **If** the required physical demands meet or exceed the criteria given on the checklist, check the appropriate boxes and make appropriate notes (e.g. actual force level, specific action/task being performed).
   b. **If there is an increased risk of developing MSDs**, the checklist can be used to begin discussions on how to implement controls to reduce the risk for workers.
   c. **If** the checklist does not indicate that there is an increased risk of developing MSDs, and there are no reports of work-related pain or discomfort, then document and communicate the results of the risk assessment. See Section 8 of the MSD Prevention Guideline for Ontario.

Hints to make completing the MSD Risk Assessment Checklist easier!

a. Grip and push/pull forces are easily measured using grip and push/pull force gauges. If you don't have these tools, consider using the method described on page 14, **Estimating grip and push/ pull forces.**
b. Observe as many workers performing the activity as is practical.
c. Ask workers about specific items on the Risk Assessment Checklist if you are unsure.
d. If the physical demands vary from day to day, due to different products or services being produced or provided, ask workers if the activity being observed is more or less demanding than on a typical day.
   i. If less demanding, plan to come back when the demands are more typical.
   ii. If more demanding, complete the checklist. It may be that the risk of MSDs is only increased when working with certain products or performing certain services. You should also reuse the checklist when the demands are more typical.
   iii. If typical, but there are times when the demands are higher, reuse the checklist when the demands are higher, especially if an increased risk is not indicated by the checklist when observing typical demands.
e. **For non-repetitive activities** total up the time spent performing the specific activity over the day.
f. **For repetitive actions** (e.g. the same motion is done more frequently than once every 6 – 30 seconds) add up the total time that the specific repetitive action is performed over the day.
g. **If the duration** for a specific activity/action varies from day to day, use the Risk Assessment Checklist when the duration is typical and again when the duration is longest.

MSD Risk and Grip Force	
Pinch Grips	Pinch grips require the worker to grip objects between the thumb and the fingers • Use a scale to weigh the object(s) being pinched or measure the grip force by using a pinch grip force gauge. If you don't have a pinch grip force gauge, consider having workers estimate the amount of force/effort required (See Appendix A). 1) Does the object weigh 1 kg or more, is the force 2 kg or more, or do the workers rate the force as '5' or more? **If yes go to 2. If no, move on to Power Grips.** 2) Total up how long the workers perform the pinch grip. Is the total time per day 2 hours or more? **If yes, check the box. If no, move on to Power Grips.**
Power Grips	Power grips require the worker to grip objects between the fingers and the palm • Use a scale to weigh the object(s) being power gripped or measure the grip force by using a hand grip force gauge. If you don't have a hand grip force gauge, consider having workers estimate the amount of force/effort required (See Appendix A). 1) Does the object weigh 5 kg or more, is the force 5 kg or more, or do the workers rate the force as '5' or more? **If yes go to 2. If no, move on to Lift / Lower Forces.** 2) Total up how long the workers perform the power grip. Is the total time per day 2 hours or more? **If yes, check the box. If no, move on to Lift / Lower Forces.**

MSD Risk and Lift / Lower Forces	
Back / Shoulder	The criteria for lifting and lowering tasks given on this risk assessment checklist are for whole body, two-handed lifting in unconstrained work postures, with little or no twisting of the trunk. Any lifting performed in constrained work postures (e.g. sitting, kneeling, in areas with low ceilings), lifting/lowering that requires twisting of the trunk, or one-handed lifting should be assessed using a more specific in-depth risk assessment method. Also, if workers repeatedly lift/lower a variety of objects of varying weights when performing the task, the risk for these workers needs to be assessed using a different risk assessment method. **Note: Use lift/lower force values that are appropriate for the workers currently performing the task. Reassess the risk if the workers performing the task change.** • Use a weigh scale to measure the weight of the object(s) being lifted/lowered. A simple low-cost bathroom scale will suffice. • How often do workers lift/lower these objects? • Is the object '**close to' or 'far from'** the body? 1) Close to the body – hands are no more than 17 cm away from the front of the body 2) Far from the body – hands are, at any time, more than 17 cm away from the front of the body • Is the distance of lift/lower **'short' or 'long'**? 1) Short – the object moves up/down no more than 25 cm 2) Long – the object moves up/down more than 25 cm

MSD Risk and Lift / Lower Forces (continued)	
Back / Shoulder	• Where are the workers' hands at the end of the lift/lower (e.g. when the object is set down)? 1) at or below knuckle height 2) between knuckle and shoulder height 3) at or above shoulder height • Is the task performed by only males, by both males and females, or by females only? Compare the lifting-/lowering-related information to the appropriate table to determine if the weight of the objects being lifted/lowered increases the risk of MSD for the workers performing the job. If the actual weight being lifted/lowered is more than the weight given in the table, for the specific type of lift/lower, then the risk of MSD is increased due to required lifting/lowering. **Move on to Push/Pull Forces.**

MSD Risk and Push / Pull Forces	
Back / Shoulder	The criteria for pushing and pulling tasks addressed by this risk assessment checklist are for whole body pushing/pulling in unconstrained work postures, with little or no twisting of the trunk. Any pushing/pulling in constrained postures (e.g. sitting, kneeling, in areas with low ceilings), pushing/pulling that requires twisting of the trunk, or one-handed pushing/pulling (levers, objects on a table) should be assessed separately for the presence of MSD hazards and the need for further risk assessment. **Note: Use push/pull force values that are appropriate for the workers currently performing the task. Reassess the risk if the type of workers performing the task changes.** • Use a push/pull force gauge to measure the force required to get the item/object being pushed/pulled moving. If you do not have a push/pull force gauge, you can buy an inexpensive spring scale (40 kg capacity) that may be helpful, or have workers estimate the amount of force/effort required (See Appendix A). • How often do the workers push/pull the object? • How far do the workers push/pull the object? • Is the task performed by only males, by both male and females, or by females only? Compare the push/pull-related information to the appropriate table to determine if the force required to push/pull the object increases the risk of MSD for the workers performing the job. If the actual force being exerted is more than the force given in the table, for the specific type of push/pull, then the risk of MSD is increased due to required pushing/pulling. **Move on to Awkward Postures.**

MSD Risk and Awkward Postures	
Neck	Awkward neck postures include bending forward (flexion), bending to one or both sides, twisting (rotation), and bending backward (extension). For neck postures, you can take digital pictures and measure 'degree' of posture with a protractor. You can also estimate the angle by watching the worker perform the task. For forward and side bending of the neck, consider whether the neck has an obvious bend in it. Is the chin dropped down towards the chest? Is one ear closer to the shoulder? For twisting, consider whether the neck has an obvious twist to one side. Is the chin moved so that it is at least halfway between facing forward and touching/being over the shoulder? For backward bending, only a slight movement of the head backward will result in 20 degrees of extension. Also, if the worker's chin is obviously 'pushed out forward' this will lead to 20 degrees or more of neck extension. • Observe the job/task being performed. Is the neck held for more than a few seconds at a time in an awkward posture? **If yes**, calculate the total amount of time per day/shift that workers spend with the neck in the awkward posture(s). **If no, move on to Awkward Postures – Shoulder.** • Is the total amount of time per day/shift spent in this posture more than 2 hours over the day? **If yes,** indicate that awkward neck posture MSD hazards exist by checking the appropriate box(es). **If no, move on to Awkward Postures – Shoulder**
Shoulder	Awkward shoulder postures considered by this checklist include working with one or both hands above the head or working with one or both elbows at or above the shoulders. This can happen when the hands or arms are used in front of the body or to out to the side. For shoulder postures you can take a digital picture in order to better see if the hand(s)/elbow(s) are above the head/shoulder. However, it is usually quite easy to see this just by observing the worker perform the task. • Observe the job/task being performed. Are the hand(s) used at or above the head, or are the elbow(s) at or above the shoulder for more than a few seconds at a time? **If yes**, calculate the total amount of time per day/shift that workers spend with the shoulder(s) in the awkward posture(s). **If no, move on to Awkward Postures** – **Back** • Is the total amount of time per day/shift spent in this posture more than 2 hours over the day? **If yes,** indicate that awkward shoulder posture MSD hazards exist by checking the appropriate box(es). **If no, move on to Awkward Postures – Back**

MSD Risk and Awkward Postures (continued)	
Back	Awkward back postures considered in this checklist include bending forward (flexion), bending sideways, twisting (rotation), and bending backward (extension). For back postures, you can take digital pictures and measure 'degree' of posture using a protractor. You can also estimate the angle by watching the worker perform the task. For forward and side bending of the back, consider if the back has an obvious forward or sideways bend in it. For twisting, consider if the back has an obvious twist in either direction. Are the shoulders facing in a different direction than the hips or feet? For backward bending, only a slight movement of the back backwards will result in 20 degrees of extension. **NOTE: the back must be unsupported (i.e. no back rest) for this to be considered an MSD hazard.** • Observe the job/task being performed. Is the back held for more than a few seconds at a time in an awkward posture? **If yes**, calculate the total amount of time per day/shift that workers spend with the back in the awkward posture(s). **If no, move on to Awkward Postures – Knees.** • Is the total amount of time per day/shift spent in this posture more than 2 hours over the day? **If yes,** indicate that awkward back posture MSD hazards exist by checking the appropriate box(es). **If no, move on to Awkward Postures – Knees.** • Circle the appropriate back postures. **Move on to Awkward Postures – Knees.**
Knees	Squatting and kneeling postures are stressful for the knees. • Observe the job/task being performed. Does the worker squat and/or kneel for more than a few seconds at a time? **If yes**, calculate the total amount of time per day/shift that workers spend squatting and/or kneeling. **If no, move on to Static Whole Body Postures.** • Is the total amount of time per day/shift spent in this posture more than two hours over the course of the day? **If yes,** indicate that awkward knee posture MSD hazards exist by checking the box. **If no, move on to Static Whole Body Postures.**

MSD Risk and Static Whole Body Postures	
Prolonged Sitting and/or Prolonged Standing	Prolonged sitting or standing have both been shown to increase the risk of back and lower limb MSDs. • Observe the job/task being performed. • Does the worker sit for a total of more than six hours a day/shift? **If no, consider prolonged standing.** • Does the worker stand in one location, on a hard surface, for more than four hours a day/shift? - NOTE: standing means that workers do **not** move more than two steps in any direction while working. If workers are standing on anti-fatigue matting (matting that is manufactured and marketed as anti-fatigue matting) then move on to Repetition. **If yes,** indicate that static whole body posture MSD hazards exist by checking the appropriate box(es). **If no, move on to Repetition.**

MSD Risk and Repetition	
Neck, Shoulders, Elbows, Wrists, or Hands	Repetitive movements and activities have been shown to increase the risk of MSD. The motions/ activities that should be considered when completing the hazard identification tool include repetitive: - neck movements (forward, backward, twisting, sideways) - shoulder/arm movements (shrugging, reaching forward, reaching backward, reaching across the body, reaching out to the side) - elbow movements (bending, rotation of forearm – palm of hand up, palm of hand down) - wrist movements (bending up, down, to either side) - hand movements (pinch/power gripping) • Observe the job/task being performed. • Does the worker perform tasks that require repetitive motions/activities? **If yes,** do workers perform the tasks that require repetitive motions/activities for more than two hours a day/shift? **If no, move on to Keyboarding.** **If yes,** indicate that MSD hazards related to repetition exist by checking the box. **If no, move on to Keyboarding.** • Check the body parts that apply. **Move on to Keyboarding.**
Keyboarding	Intensive keyboarding is defined as keying with the hands or fingers in a rapid, steady motion with few opportunities for temporary work pauses. • Observe the job/task being performed. • Do workers perform intensive keyboarding tasks for more than four hours of the day/shift? • **If yes,** indicate that keyboarding MSD hazards exist by checking the box. **Move on to Repeated Impacts.**

MSD Risk and Repeated Impacts	
Hands / Knees	Using the hand or knee as a 'hammer' is considered an MSD hazard due to the potential for damage to muscles, ligaments, nerves and blood vessels. • Observe the job/task being performed. • Do workers use either the hand(s) or knee(s) as a hammer (hit the palm or base of the hand(s), or the knee (s) against an item/object/tool) more than 10 times an hour? **If yes,** do they do this task for more than two hours total per day/shift? **If no, move on to Hand-Arm Vibration.** **If yes,** check the body part(s) that apply **and** indicate that hand/knee MSD hazard exist by checking the box. **If no, move on to Hand-Arm Vibration.**

MSD Risk and Hand-Arm Vibration	
Hands / Wrists	Using vibrating hand tools has been shown to be a hazard for hand and wrist MSDs. • Observe the job/task being performed. • **Do workers use** hand tools that are known to have high levels of vibration (e.g. impact wrenches/drills, carpet strippers, chain saws, jackhammers, scalers, rammers, tampers, riveting hammers)? **If yes,** do they use these tools for more than 30 minutes total per day/shift? **If no, consider use of tools with moderate levels of vibration.** **If yes,** indicate that MSD hazards due to the use of high vibration hand-tools exist by checking the appropriate box. **Complete checklist and review findings with appropriate workers.** • **Do workers use** hand tools that are known to have moderate levels of vibration (e.g. grinders, sander, jig saws, circular saws, etc.) for more than two hours total per day/shift? **If yes,** indicate that MSD hazards due to the use of moderate vibration hand tools exist by checking the appropriate box. **Complete checklist and review findings with appropriate workers.**

Estimating Grip and Push / Pull Forces

The following methods can be used to estimate grip and push/pull forces if you do not have any other way to measure these forces. This procedure is based on research indicating there is a good relationship between the estimates of effort provided by workers and the actual percentage of their maximum force being exerted. The accuracy of this method improves greatly when workers are first asked to grip and/or push/pull something as hard as they can.

CAUTION REQUIRED: Ideally the workers should grip and/or push/pull something as hard as they can while using the actual work posture required to perform the activity. However, even though the risk of injury associated from a one-time, short-duration high-level force exertion, in an awkward posture, is very small, **it is recommended that the workers grip and/or push/pull something as hard as they can while using non-awkward, good body posture.**

CAUTION REQUIRED: Ask the workers if they are feeling any pain or discomfort in their fingers, hands, wrists, and/or forearm before asking them to grip something as hard as they can. For pushing/pulling ask the workers if they are feeling any pain or discomfort in their shoulders, neck, upper back, lower back, or legs before asking them to push/pull on something as hard as they can. **If a worker is experiencing pain or discomfort, do not ask the worker to perform either of these tasks.**

a. Observe the worker performing the task (pinch or power gripping, pushing/pulling)

b. Ask the worker to stop doing the task.

c. Tell the worker that you are going to ask them to rank, on a scale from 0 to 10 how much force they need to exert when performing the gripping, pushing and/or pulling activity. Tell them that a '0' on this scale means no effort and a '10' means 'as hard as you can/using as much force as you can generate'.

d. Have the worker do the task again for a few more minutes/cycles.

e. Ask the worker to stop doing the task.

f. If looking at pinch or power gripping, have them pinch or power grip something solid as hard as they can for 3-4 seconds.

g. If looking at pushing or pulling, have them push or pull on something that will not move as hard as they can for 3-4 seconds.

h. Now ask the worker to perform the gripping or pushing/pulling required one time only. As soon as they have done this, ask them to compare the amount of effort/force needed to do the task to how hard they gripped, pushed, pulled a few minutes ago when you asked them to grip, push, pull as hard as they could. **Ask them, "If the hardest you can grip, push or pull is a 10, how much effort/force is needed to perform the task, from 0 to 10?"**

i. **For pinch and power gripping,** if one or more workers tell you that the effort required to perform the task is **'5' or higher** and gripping is done for 'more than two hours total per day, then place a check mark in the appropriate box – indicating that an MSD hazard exists.

j. **For pushing/pulling,** if one or more workers tell you that the effort required to perform the push or pull is **'5' or higher**, place a check mark in the appropriate box - indicating that an MSD hazard exists.

Checklist Risk Assessment Methods (continued)

Washington State Caution Zone Checklist

The Washington State Caution Zone Checklist was developed as part of a regulatory effort to control exposure to MSD hazards in workplaces in Washington State. It can be used as a screening tool for typical work activities. Typical work activities are regular and:

- a foreseeable part of the job;
- occur on more than one day per week; and
- occur more frequently than one week per year.

Washington State defined caution zone jobs as those jobs that have a 'sufficient degree of risk' so that workers performing these jobs should be provided with training related to MSD hazards and that further risk assessment should be done and controls implemented.

For a copy of the Washington State Caution Zone Checklist see:
- http://www.lni.wa.gov/Safety/Topics/Ergonomics/ServicesResources/Tools/default.asp

Washington State Hazard Zone Checklist

The Washington State Hazard Zone Checklist was developed as part of a regulatory effort to control exposure to MSD hazards in workplaces in Washington State. It was developed to provide workplaces with a relatively simple option for performing further risk assessment on jobs that had been identified as caution zone jobs.

The checklist criteria are at levels that, according to the developers, would put most workers at a high risk of developing a work-related MSD if exposed to those levels on a regular basis.

The hazard zone checklist was provided as one option for risk assessment, but workplaces were free to use other acceptable risk assessment methods.

For a copy of the Washington State Hazard Zone Checklist see:
- http://www.lni.wa.gov/Safety/Topics/Ergonomics/ServicesResources/Tools/default.asp

Manual Material Handling Risk Assessment Methods
ACGIH Lifting TLV

Full Name:

American Conference of Governmental Industrial Hygienists Lifting Threshold Limit Values (TLV)

Overview / Purpose:

The ACGIH Lifting TLV was released in 2004 in order to provide guidance to workplaces on acceptable weight limits for lifting tasks. It is designed to provide weight TLVs, for specific lifting conditions, that would protect nearly all workers from work-related low back and/or shoulder disorders associated with repetitive lifting. The team that developed the lifting TLV had a goal to develop an accurate, up-to-date, and easy to use guideline.

Body Parts Assessed:

Primarily low back, but also shoulders

Types of Jobs / Tasks:

This method can be used to assess most lifting tasks. See the limitations for this method below.

Work Settings:

This method should be useful in any work setting.

MSD Hazards Considered:

Force: ☑ Posture: ☑ Repetition: ☑ Duration: ☑ Other: ☐

Brief Description of Method Process:

The user must first consider if the method is designed to be used for the lifting task being assessed. See the limitations below for the task related factors that would make it inappropriate to use this method.

If the method is appropriate, the user needs to determine:

- **Lifting Duration:** is lifting done for less than or equal to two hrs. a day/shift, or for more than two hrs. a day/shift
- **Lifting Frequency:** the number of lifts a worker performs per hour.
- **Lifting Height Zone**: the lifting height zone is based on the location of the hands at the **beginning** of the lift.
- **Horizontal Location:** the distance from a point that is mid-way between the worker's ankles to a point that is mid-way between the worker's hands.

The user will use one of three tables provided to determine the lifting TLV for the task, depending on lifting duration and lifting frequency.

Equipment Required:

A tape measure is required to take distance measures
A weigh scale or force gauge is required to measure the weight of the object(s) being lifted.

Interpreting Results:

As noted above, the ACGIH tables provide weight values that, for the task specific lifting conditions, are considered to be safe for nearly all workers (e.g. that nearly all workers can repeatedly lift, day after day, without developing work related low back and shoulder disorders).

Appropriate control measures should be implemented any time the Lifting TLVs are exceeded OR lifting related MSDs are reported.

Limitations:

This method should not be used if any of the following is true:

- the trunk/twists rotates more than 30 degrees to either side
- more than 360 lifts per hour are required
- lifting is done for more than eight hours a day
- a constrained body posture is used when lifting (kneeling, restricted head room, seated, crouching)
- one handed lifting is required
- lifting is done in high heat and/or humidity
- the objects being lifted are unstable (containers with shifting centre of mass, people, animals)
- the object being lifted has poor hand holds or grasping points
- the workers' footing is unstable (slippery floor, unstable ground or surface)

If any of these situations exist, professional judgment should be used to reduce weight limits below those recommended in the TLVs.

This method is not specifically designed for lowering tasks but would likely be applicable.

This method is not applicable for use with other material handling tasks such as carrying, pushing, and/or pulling.

As with most risk assessment methods, a general risk level is provided but it cannot predict injuries to individual operators.

As with most risk assessment methods, this method does not account for individual risk factors including gender, age, or medical history.

Originally published in:

American Conference of Governmental Industrial Hygienists (ACGIH) (2004), 2004 Threshold Limit Values for Chemical Substances and Physical Agents & Biological Exposure Indices, Cincinnati, OH

For more information see

Interpretation of the ACGIH Lifting TLV by T. Bernard:

- http://personal.health.usf.edu/tbernard/HollowHills/LiftingTLV11.pdf

Note: 2nd set of tables provided, based on professional judgment, to overcome some of the limitations of this method

ACGIH On-line Store:

- http://www.acgih.org/Store/ProductDetail.cfm?id=1788

Chapter 50, Fundamentals and Assessment Tools for Occupational Ergonomics, Marras and Karwowski (ed), 2006

- obtain this book through interlibrary loan at local public, college or university library.

Manual Material Handling Risk Assessment Methods
NIOSH Lifting Equation (1991)

Full Name:

National Institute for Occupational Safety and Health (US): Revised NIOSH Lifting Equation (1991)

Overview / Purpose:

The NIOSH Lifting Equation was first developed in 1981 and was revised in 1991 to include additional parameters (i.e. twisting, grip). This tool provides guidance to workplaces on acceptable weight limits for lifting tasks that, according to the tool developers, would protect nearly all workers from work-related low back disorders associated with lifting and lowering.

Body Parts Assessed:

Low back

Types of Jobs / Tasks:

This method can be used to assess two-handed lifting and lowering tasks with some limitations (see below). It is most useful for jobs where the weight of the items being lifted is consistent.

Work Settings:

This method should be useful in any work setting where workers perform two-handed lifting/lowering tasks of 'non-living' loads (i.e. not people).

MSD Hazards Considered:

Force: ☑ Posture: ☑ Repetition: ☑ Duration: ☑ Other: ☐

Brief Description of Method Process:

The user must first determine if the lifting task can be assessed using the NIOSH Lifting Equation (see limitations below).

The user must then collect the data required for input into the equation. The data needed includes:

- The weight of the object being lifted/lowered, in kg. If the weight of the objects being lifted/ lowered differs, record the maximum and the average weights.
- Height of the hands, in cm, at both the start and end of the lift/lower. (V)
- The vertical travel distance, in cm, of the hands (D) from the start to the end of the lift.
- The horizontal distance in cm of hands on the load from the mid-point between the ankles at the start and end of lift. (H)
- Angular location of the load relative to a line 'sticking out' from the worker's navel, if the worker was standing in a neutral posture. Measured in degrees at both the start and end of lift. (A)
- Frequency of lifts (average number of lifts per minute and total duration of lifting). (F)
- How well the load can be grasped (based on presence and type of handles). (C)

All of the variables are then converted into multipliers and entered into the NIOSH Lifting Equation:

Recommended Weight Limit (RWL) = LC x HM x VM x DM x AM x FM x CM
LC = Load Constant = 23 kg

The RWL should be calculated for each lifting/lowering task at both the start and end of the lift/lower. This is especially important when the workers twist during the lift/lower or when the horizontal distance of the hands is different at the start or end of the lift/lower.

Once the RWL is calculated, NIOSH suggests that a Lifting Index (LI) be calculated for each task, at both the start and end of the lift/lower. The Lifting Index is a ratio of the calculated RWL and the actual weight of the object being lifted/lowered.

Lifting Index (LI) = Actual Load Weight / Recommended Weight Limit

Equipment Required:

A tape measure is required to take distance measures.
A weigh scale or force gauge is required to measure the weight of the object(s) being lifted/lowered.
A protractor or goniometer can be used to measure angle of asymmetry or this can be estimated.

Interpreting Results:

This NIOSH Lifting Equation assumes a lifting limit of 23 kg (51 lbs) under ideal conditions. As conditions become less than ideal the recommended weight limit for the task is reduced from this baseline of 23 kg.

The calculated RWL is, according to NIOSH, the weight that can be lifted/lowered under the task specific conditions, by 90 per cent of healthy workers (male and female) without increased risk of lifting-related low back pain.

If the actual weight being lifted exceeds the RWL, at either the start or end of the lift/lower, then NIOSH suggests that the risk of lifting-related low back pain is increased for the workers performing the job.

NIOSH suggests that the lifting index (LI) can be used to assess the relative risk of different lifting tasks. When the LI is greater than 1.0, there is an increased risk of lifting-related low back pain and changes should be considered. NIOSH also suggests that when the LI is greater than or equal to 3.0, the risk of lifting-related low back injury is very high and that almost all workers would be at an increased risk. When the LI is greater than or equal to 3.0, changes to the design of the lifting/lowering task are strongly recommended.

Limitations:

This method does not take into account whole-body vibration, or non lifting/lowering MSD hazards.

This method can not be used for:

- one-handed lifting/lowering
- lifting/lowering tasks that are done for more than eight hours
- lifting/lowering while seated or kneeling
- lifting/lowering in restricted work spaces
- lifting/lowering of unstable objects, people or animals
- carrying/pushing/pulling tasks (including use of a wheelbarrow or shovel)
- lifting/lowering on slippery surfaces
- lifting/lowering in unfavorable environments.

As with most risk assessment methods, a general risk level is provided but it cannot predict injuries to individual operators.

As with most risk assessment methods, this method does not account for individual risk factors including gender, age, or medical history.

Originally published in

Waters, T.R., Putz-Anderson, V., Garg, A. and Fine, L.J, 1993, Revised NIOSH equation for the design and evaluation of manual lifting tasks, Ergonomics, 36(7): 749-776

For more information see

Applications Manual for the Revised NIOSH Lifting Equation:
- http://www.cdc.gov/niosh/docs/94-110/

CCOHS OHS Answers:
- http://www.ccohs.ca/oshanswers/ergonomics/niosh/
- includes an on-line calculator

WorkSafe BC's Lift/Lower Calculator (based on NIOSH Lifting Equation):
- http://www2.worksafebc.com/calculator/llc/Default.htm

ErgoWeb Information Page
- http://www.ergoweb.com/news/detail.cfm?id=566

A NIOSH Lifting Equation worksheet (Imperial units)
- http://personal.health.usf.edu/tbernard/HollowHills/NIOSHWPGM11.pdf

Manual Material Handling Risk Assessment Methods
Snook Tables

Full Name:

Liberty Mutual Manual Materials Handling Tables

Overview/ Purpose:

The Snook Tables, as they are commonly known, were developed to provide maximum acceptable weight limits (MAWL) for different manual handling tasks. The data in the tables was derived using a 'psychophysical approach' where subjects were asked to make adjustments to the weight/force so that they would be able to "work all day as hard as possible on an 'incentive basis' without straining or becoming unusually tired, weak, out of breath or overheated."

Body Parts Assessed:

Primarily low back, but also shoulders and legs, also the load on the cardiovascular system

Types of Jobs/Tasks:

By using the appropriate charts, the method can be used to assess most lifting, lowering, carrying, pushing and/or pulling tasks. See the limitations for use of this method below.

Work Settings:

This method should be useful in any work setting.

MSD Hazards Considered:

Force: ☑ Posture: ☑ Repetition: ☑ Duration: ☑ Other: ☐

Brief Description of Method Process:

The user must first select the correct "Table" to use for the assessment. For each type of manual material handling (lifting, lowering, carrying, pushing, pulling) separate tables are provided for both males and females. If the task is performed by both males and females, use the female table.

The user needs to measure the weight of the object being lifted, lowered, or carried. For pushing and pulling tasks the user needs to measure the amount of force required to get the item moving (initial force) and then measure the amount of force it takes to keep the item moving (sustained force).

Other data required for this method include:

- **Hand distance (width):** the distance from the front of the body to the hands. This will normally be half the width of the object being handled unless the object is purposely held away from the body.
- **Lift/lower distance (distance):** the distance of travel of the hands while lift or lower taking place.
- **Hand height (height):** height of the hands on the object being pushed or pulled, or the height of the hands when carrying a load.
- **Push/pull/carry distance:** distance the item is pushed or pulled, or carried.
- **Frequency:** the number of lifts, lowers, pushes, pulls or carries expressed in terms of number of activities done in 'x' seconds, minutes, or hours (see tables).

- **Lift/lower zone**: the area of the body in which the lift/lower finishes. Take note of the position of the hands when the worker had completed the lift/lower (floor to knuckle, knuckle to shoulders, or shoulder to overhead reach)

Note: in some cases a worker will perform lifting, lowering, pushing, pulling, and/or carrying as part of one job. If so, data should be collected for each type manual handling and the total manual handling frequency should be calculated (e.g. total number all lifts/lowers done in 'x' seconds, minutes, or hours.)

The values are used to select the most appropriate column or row in the appropriate table. The tables indicate the percentage of the population of workers that should be able to do the task as a regular part of daily work. In many cases, the data collected will not exactly match the values provided in the table. When this happens, select the table value that most closely matches the values measured at the job/ task.

Equipment Required:

- A tape measure is required to take distance measures.
- A weigh scale or force gauge is required to measure the weight of the object(s) being lifted/ lowered or carried, and the forces required for pushing and pulling.

Interpreting Results:

As noted above, the tables provide weight/force values, for specific types of tasks that are deemed to be acceptable to a defined percentage of the population.

When the task specific data does not match the values in the table, it is suggested that the user select the table value that is closest to the actual task requirements, bearing in mind that selecting the next highest value in the table, for any of the specific criteria, will result in a more protective assessment result.

The creators of this method suggest that jobs that require many different manual handling tasks (lifting, lowering, pushing, pulling, and/or carrying) can be assessed using this method. This is done by comparing data for each of the specific manual handling tasks against the appropriate table but by using the 'total frequency for all the tasks' as the frequency value to determine the percentage of the population that would find the task to be acceptable. For instance, if a job requires lifting at a rate of one lift every two minutes, a push every five minutes and a carry every five minutes, the worker would do four and a half 'tasks' over five minutes, or rounding down, one task per minute. The user should then compare the data for the lift, carry and push, against the appropriate table but use the same frequency (one per minute) for each to determine a result.

It has been suggested that any task that cannot be performed by at least 75 per cent of the population should be considered for redesign. When a mixture of males and females are doing the task, the task should be designed so that it is acceptable to at least 75 per cent of the female population, which would make it acceptable to more than 90 per cent of the male population.

Limitations:

This method does not consider any trunk rotation/twisting that may take place while performing the task.

This method is not suitable for use when the task involves one-handed lifting, lowering, carrying, pushing or pulling. The method is also not useful for tasks that involve throwing or catching of objects.

Some combined tasks may exceed recommended physiological limits for an eight-hour shift.

Some weights may exceed recommended physiological limits during an 8-hour shift, as noted by italics in the tables.

As with most risk assessment methods, a general risk level is provided but it cannot predict injuries to individual operators.

As with most risk assessment methods, this method does not account for individual risk factors including age, or medical history.

Originally published in:

Snook, S. H. and Ciriello, V. M.; The design of manual handling tasks: revised tables of maximum acceptable weights and forces, Ergonomics, 34:9 1197-1213, 199l.

For more information see:

Clemson University Industrial Engineering:
- http://www.ces.clemson.edu/ie/research/labs/Ergonomicstools/snook.pdf

On-line calculator for pushing, pulling, carrying from Worksafe BC, based on Snook Tables:
- http://www2.worksafebc.com/ppcc/footer/about.htm

Updated version of tables from Liberty Mutual (in imperial units only)
- http://libertymmhtables.libertymutual.com/CM_LMTablesWeb/

Manual Materials Handling Risk Assessment Methods (continued)

Manual Handling Assessment Charts (MAC) (U.K.)

The Manual Handling Assessment Charts (MAC) were designed to help with the assessment of the most common risk factors in lifting (and lowering), carrying and team handling operations.

For more information see: http://www.hse.gov.uk/msd/mac/index.htm

Mital et. al. Tables

The Mital tables were developed by Mital, Nicholson and Ayoub in 1993. Using the data from Snook and Ciriello, they created a set of tables of maximum acceptable weight limits that were adjusted for various biomechanical, physiological, and epidemiological criteria. In addition, they provide a number of other adjustments to provide weight limits based on other factors that can significantly affect the maximum acceptable weight of industrial workers. These factors include:

- working duration
- limited headroom
- asymmetrical lifting (twisting and lifting/lowering)
- load asymmetry (uneven loads/unbalanced loads)
- couplings (grip characteristic)
- load placement clearance
- heat stress.

The Mital tables can be used for the evaluation and design of manual handling (lifting, lowering, pushing, pulling and carrying) tasks. The Tables can also be used for one-handed horizontal lifting, one-handed carrying, holding, and material handling in unusual postures.

For more information see:

Mital A and Nicholson and Ayoub M.M. 1997 A Guide to Manual materials handling (2nd Edition): Taylor & Francis

- obtain this book through interlibrary loan at a local public, college or university library.

Upper Limb Risk Assessment Methods
ACGIH Hand Activity Level (HAL)

Full Name:

American Conference of Governmental Industrial Hygienists Threshold Limit Value for Hand Activity Level (HAL)

Overview/ Purpose:

The ACGIH HAL is a hand activity assessment tool designed to assess the risk of MSDs from exposure to repetitive hand, wrist and forearm work.

Body Parts Assessed:

Hands, wrists, forearms

Types of Jobs/Tasks:

The method can be used to assess:

- any task that involve the same, or very similar repetitive hand, wrist or forearm exertions
- tasks that are performed for at least four hours a day/shift

Work Settings:

This method should be useful in any work setting. The method has been used in various manufacturing, meat processing and office settings.

MSD Hazards Considered:

Force: ☑ Posture: ☐ Repetition: ☑ Duration: ☑ Other: ☐

Brief Description of Method Process:

An observer/user identifies the hand activity level (HAL) on a scale of 0 (virtually no activity) to 10 (highest imaginable level of activity). Activity is considered to be a combination of both repetition and how much of the cycle the hand is exerting force.

The level of hand force (normalized peak force or NPF) can be measured in a variety of ways. The hand forces can be measured using a force gauge and from this the percentage of maximum hand force can be calculated. The hand forces can also be assessed by asking the person doing the task to rate the level of effort on a scale of 0 – 10, or by having the observer rate the effort level.

The normalized force and hand activity level are then plotted on the graph provided in the ACIGH HAL OR the ratio of the NPF to the HAL: (NPF / 10 –HAL) is calculated

Equipment Required:

A grip dynamometer (force gauge) can be used to measure grip forces but is not required.
Use of a stopwatch is recommended.

Interpreting Results:

The ACIGH HAL method proposes two limit values, a TLV (Threshold Limit Value) and an AL (Action Limit).

The ACIGH HAL TLV is the level/value above which it is recommended that a program of controls be implemented to avoid MSDs.

- the ACIGH HAL TLV is: 0.78

The ACIGH HAL AL (Action Limit) is the level/value below which it is felt that the risk of workers developing an MSD is acceptable (low), as long as exposure to other factors, e.g., posture, contact stress and vibration are not excessive.

- the ACIGH HAL AL is: 0.56

If the result for the task is between the AL and the TLV it is suggested that a program of education and surveillance be implemented, and/or proactive job improvements occur to reduce the risk to a level that is at or below the AL.

Arm, grip and wrist/forearm postures should be considered in the interpretation of the score.

Limitations:

Many issues are left up to the professional judgment of the observer/analyst.

This risk assessment method does not account for sustained non-neutral postures, contact stresses, low temperatures, or vibration exposure.

This risk assessment method only considers repetition and force applied to monotonous hand work performed for 4 or more hours per day.

As with most risk assessment methods, a general risk level is provided but it cannot predict injuries to individual operators.

As with most risk assessment methods, this method does not account for individual risk factors including gender, age, or medical history.

Originally Published In:

American Conference of Governmental Industrial Hygienists (ACGIH). Threshold limit values and biological exposure indices for 2001. Cincinnati: ACGIH, 2001.

For More Information See:

A worksheet to help complete the ACIGH:HAL can be found at:

- http://personal.health.usf.edu/tbernard/HollowHills/HALTLVM15.pdf

University of Michigan ACGIH:HAL information at:

- http://umrerc.engin.umich.edu/jobdatabase/RERC2/HAL/ACGIHTLV.htm

UAW Occupational Health & Safety

- http://www.uaw.org/hs/03/01/hs06.cfm

Upper Limb Risk Assessment Methods
Rapid Upper Limb Assessment

Full Name:

Rapid Upper Limb Assessment (RULA)

Overview/ Purpose:

RULA is a method designed to provide a quick analysis of the demands on a workers upper limb. It provides an objective measure of the MSD risk caused by tasks where the demands on the upper body are high but the whole body demands (i.e. the back, legs) are relatively low.

Body Parts Assessed:

Primarily the upper limb (hand, wrist, elbow, shoulder), but also the neck and low back (due to trunk postures).

Types of Jobs/Tasks:

The method can be used to assess most tasks where the worker uses primarily the upper limbs to complete the task. Typically, the worker is seated or standing without much movement when performing the task. Examples of tasks that are suitable for a RULA analysis include computer based tasks, manufacturing and retail/cashier type tasks. See the limitations for use of this method below.

Work Settings:

This method should be useful in any work setting for tasks as described above.

MSD Hazards Considered:

Force: ☑ Posture: ☑ Repetition: ☑ Duration: ☑ Other: ☐

Brief Description of Method Process:

The user must ensure that the worker uses primarily the upper limb to perform the task, and that the task is performed while the worker is seated or standing still. If this is not the case, they should consider using another method (e.g. REBA).

To do a complete RULA analysis, the user decides which postures or parts of the work cycle need to be assessed. To do this it is important for the user to look at the postures used over a full task cycle. After this they can select the posture to be assessed. Often those postures that are held the longest and/or considered to be 'the worst' are assessed.

It is then necessary to decide whether the left, right or both sides of the body should be assessed. RULA is actually designed to look at the left and right hand sides separately. If both sides are assessed, RULA will provide a score for each side.

For each side of the body the user will:

- Score the position of the upper arm (shoulder posture), lower arm (elbow posture), and wrist, adjusting the score for more extreme postures
- Decide if the worker works mostly with their hand/forearm in neutral (so the thumb is pointing up), or if they work with the palm of the hand facing up or down. If neutral, score the 'wrist twist' as being 'mainly in mid-range'. If facing up or down, score the 'wrist twist' as 'at or near the end of twisting range'.

- Look at 'Table A' on a RULA worksheet to determine the combined score for the right or left upper limb.
- Determine the score for muscle use by deciding if the upper limb posture(s) already scored is mainly static (held for greater than 1 min.) or if it is repeated 4 or more times a minute.
- Determine the score for force/load by considering the amount of force or load that is placed on/exerted by the upper limb.
- Total up the scores for muscle use, force/load and upper limb posture (from Table A).

Now the user will:

- Score the posture of the neck, trunk (lumbar spine/trunk posture), and legs, adjusting the score for more extreme neck and trunk postures.
- Determine the score for the legs.
- Look at 'Table B' on a RULA worksheet to determine the combined score for the Neck, Trunk and Legs.

Finally, the user will:

- Use 'Table C' on a RULA worksheet to find the final or 'Grand' score for the task (right or left side).

Equipment Required:

A weigh scale, push/pull force gauge, and/or a hand grip/pinch grip force gauge are recommended to measure the forces/loads required for the task. If this equipment is not available it may be adequate to have the workers performing the task estimate the force/load levels.

A stopwatch may also be used but is not required.

Interpreting Results:

As noted above, the RULA method needs to be applied separately to both the left- and right-hand sides of the body. For each analysis, RULA determines a 'Grand' or final score. As such, for most jobs/tasks, using the RULA method will provide you with a final score for the left side of the body and a final score for the right side of the body.

RULA does not have a method for combining the scores from a left- and right-hand side assessment.

The creators of the RULA method provide a series of 'action levels' based on the final score.

- Final score of 1 or 2: posture is acceptable if it is not maintained or repeated for long periods
- Final score of 3 or 4: further investigation is needed, changes may be required
- Final score of 5 or 6: investigation and changes required soon
- Final score of 7: investigation and changes are required immediately

Limitations:

This method is not applicable for assessing manual material handling tasks, or tasks that involve significant moving around the work area.

The method is not suitable for assessing tasks that have unpredictable work postures, or for assessing jobs that involve a number of different and varying tasks.

The method only allows for the separate assessment of right- and left-hand sides of the body, and there is no method to combine these scores into a total body risk score.

The method only allows for looking at either one point of time or at the 'worst' postures observed for a task.

The cumulative effects of all activities performed during a job/task are not considered.

If the job/task involves unusual, difficult to categorize, or unobservable (due to production schedules, tasks required for maintenance or start-up or shut-down) the risk associated with the job/task may not be adequately reflected by the result of the method.

This method does not consider the total duration of the task, available recovery time or vibration.

As with most risk assessment methods, a general risk level is provided but it cannot predict injuries to individual operators.

As with most risk assessment methods, this method does not account for individual risk factors including gender, age, or medical history.

Originally published in

McAtamney, L. and Corlett, E.N. "RULA -: A survey method for investigation of work-related upper limb disorders. Applied Ergonomics 1993, 24(2), 91-99

For more information see

General Information on RULA Method:
- http://www.rula.co.uk/brief.html

RULA Worksheet(s):
- http://ergo.human.cornell.edu/Pub/AHquest/curula01.pdf

On-line 'calculator' for RULA Method:
- http://www.rula.co.uk/
- http://www.rula.co.uk/RULASheet.pdf (requires going 'on-line' to complete assessment)

Chapter 7, Handbook of Human Factors and Ergonomics Methods, in Stanton, N. et al. (eds.) (2004)
- obtain this book through interlibrary loan at local public, college or university library.

Upper Limb Risk Assessment Methods
Strain Index

Full Name:
Strain Index (SI)

Overview/ Purpose:
The Strain Index is a risk assessment method designed to evaluate a job's level of risk for developing a disorder of the hand, wrist, forearm, or elbow. The method can also help in determining which parts of a job/task need change.

Body Parts Assessed:
Hands, wrists, forearms, elbows

Types of Jobs/Tasks:
This method can be used to assess any repetitive 'hand intensive' task

Work Settings:
This method should be useful in any work setting. The method has been developed and used in various manufacturing and meat processing settings.

MSD Hazards Considered:
Force: ☑ Posture: ☑ Repetition: ☑ Duration: ☑ Other: ☐

Brief Description of Method Process:
The observer/user must first do a task analysis to clearly identify the hand intensive tasks required to perform the job.

For each task and for each hand (right and left are assessed separately), the observer will evaluate six different variables (intensity of effort /exertion, duration of effort /exertion, number of exertions, hand/wrist posture, speed of work, and duration of task).

The result for each variable is assigned a 'score' or 'multiplier'. These scores or multipliers are then multiplied together to provide the Strain Index score.

Equipment Required:
Use of a stopwatch is recommended.

Interpreting Results:
SI scores of greater than 5 are associated with jobs that cause upper extremity MSDs. Scores less than 3 are probably 'safe'. SI scores which are greater than 7 are labeled as hazardous.

- If the SI less than 3: likely to be safe for all workers
- If the SI is between 3 and 5: uncertain, monitor the job for MSDs/discomfort
- If the SI is between 5 and 7: an elevated level of risk, monitor and implement controls if reports of MSD/discomfort
- If the SI greater than 7: a high level of risk, a program of controls is strongly recommended (hazardous job)

Limitations:

This method does not account for contact stress (soft tissue compression), cold temperatures, or hand-arm vibration.

This method does not account for recovery time between exertions.

This method only looks at MSD risk for the upper extremity, from the elbows to hands.

This method requires the observer/user to estimate three of the six variables (intensity of exertions, postures, speed of work).

The multiplier values used in the method are primarily based on the authors' professional opinions with support from physiological, biomechanical, and epidemiological principles as opposed to a mathematical relationship between task variables.

As with most risk assessment methods, a general risk level is provided but it cannot predict injuries to individual operators.

As with most risk assessment methods, this method does not account for individual risk factors including gender, age, or medical history.

Originally published in

J. Steven Moore and Arun Garg, "The Strain Index: A Proposed Method To Analyze Jobs For Risk Of Distal Upper Extremity Disorders", American Industrial Hygiene Association Journal, 56:443-458 (1995).

For more information see

Cornell University Ergonomics Site (includes a worksheet):
- http://ergo.human.cornell.edu/ahJSI.html

A worksheet can also be found at:
- http://personal.health.usf.edu/tbernard/HollowHills/StrainIndexM12.pdf

ErgoWeb Information Page
- http://www.ergoweb.com/news/detail.cfm?id=583

Chapter 9, Handbook of Human Factors and Ergonomics Methods, in Stanton, N. et al. (eds.) (2004)
- obtain this book through interlibrary loan at local public, college or university library.

Upper Limb Risk Assessment Methods (continued)

CTD Risk Index

The cumulative trauma disorder (CTD) risk index was developed from research performed in a variety of work settings (meat packers, poultry processors, garment manufacturers, metal fabricators and manufacturers of a variety of products). The index is designed to predict the upper limb MSD incident rate (based on 200,000 working hours) for a job/task.

This method uses quantitative data such as hand motion frequencies and forces to obtain a frequency factor score that estimates the strain imposed on the muscles and tendons of the wrist. Upper limb postures are included in a posture factor score and various minor job stressors are included in a miscellaneous factor score.

The CTD Risk Index method provides a quick method of screening a working population for exposure to a likely risk of work-related upper limb disorders. It also allows for the identification/assessment of hazards that interact with each other (i.e. combined effect of muscular effort or force, working posture, and performing repetitive work).

For more information see:

- http://www2.ie.psu.edu/Freivalds/courses/ie552/CTDRisk.pdf

Loading on the Upper Body Assessment (LUBA)

LUBA is an assessment technique for postural loading on the upper body. This method assigns a 'discomfort score' for each joint of the upper body, including the wrist, elbow, shoulder, neck and lower back. The score increases as the joint posture becomes more awkward/non-neutral. Scores are different depending on whether the worker is sitting or standing. An overall postural load index is calculated and four action categories (risk levels) are provided.

For more information see:

Chapter 43, Fundamentals and Assessment Tools for Occupational Ergonomics, Marras and Karwowski (ed), 2006

- obtain this book through interlibrary loan at a local public, college or university library.

Occupational Repetitive Actions Index (OCRA)

The Occupational Repetitive Actions Index (OCRA) was developed to provide analysts with a method to assess the risk of the musculoskeletal loads on workers due to posture, repetition and force. It was designed to evaluate jobs or tasks, which may expose workers to upper limb disorders (shoulder, upper and lower arms, and hand).

This method provides an OCRA risk index score which can be compared to three Action Levels: red, yellow, and green.

The method quantifies the relationship between the daily number of actions actually performed by the upper limbs in repetitive tasks, and a corresponding number of recommended actions. The recommended actions are calculated on the basis of a constant (30 actions per minute), which can be reduced, on a case-by-case basis, if other hazards are present (force, posture, additional elements, and recovery periods).

For more information see:

Risk Assessment and Management of Repetitive Movements and Exertions of the Upper Limbs
Daniela Colombini, 2002
- http://www.elsevier.com/wps/find/bookdescription.cws_home/622750/description#description

Chapter 15, Handbook of Human Factors and Ergonomics Methods, in Stanton, N. et al. (eds.) (2004)
- obtain this book through interlibrary loan at local public, college or university library.

Combined / Whole Body Risk Assessment Methods
Quick Exposure Checklist

Full Name:

Quick Exposure Checklist (QEC) for the Assessment of Workplace Risks for Work-Related Musculoskeletal Disorders

Overview/ Purpose:

The quick exposure checklist (QEC) was designed to provide a quick method to assess the risk of developing MSDs. It is a method that takes into account both the recent research on MSD hazards and the need for a quick assessment method. This method uses a checklist/score sheet that is completed by both the user and the worker.

The QEC can be used to:
- Identify risk factors for work-related MSDs.
- Evaluate risk exposure levels for different body regions.
- Suggest actions that need to be taken in order to reduce the risk exposure.
- Evaluate the effectiveness of an ergonomic intervention in the workplace.
- Educate users about the musculoskeletal risks in their workplace.

Body Parts Assessed:

Back, shoulders/arms, wrists, neck

Types of Jobs/Tasks:

The QEC method is applicable for a wide range of tasks.

See the limitations for use of this method below.

Work Settings:

This method should be useful in any work setting for tasks as described above.

MSD Hazards Considered:

Force: ☑ Posture: ☑ Repetition: ☑ Duration: ☑ Other: ☑

Brief Description of Method Process:

The QEC method allows for quick assessment of the physical activities performed by a worker. The design of the method requires the involvement of the worker in helping to identify areas of concern/ increased risk.

The one-page QEC checklist/assessment sheet includes questions that need to be answered by both the user and the worker. These questions are designed to quantify the exposure risk for the four main areas of the body (back, shoulder/arm, wrist, and neck). The exposure level scores for each of the four body areas can help to determine whether there is an increased risk for developing MSDs, and help to determine the effectiveness of any changes/implemented controls.

Before using the QEC, inexperienced users are encouraged to read the QEC Reference Guide. The Reference Guide can be found in "Further development of the usability and validity of the Quick Exposure Check (QEC)". See the information below for how to download this document.

Note: the QEC Reference Guide is an updated version of the original QEC User Guide.

Equipment Required:

Since the QEC method asks the workers to provide an answer to the question on force/load no measurement is actually required. However, a weigh scale, push/pull force gauge, and/or a hand grip/ pinch grip force gauge may be used to measure the actual forces/loads required for the task.

A stopwatch may also be used but is not required.

Interpreting Results:

The QEC method provides exposure scores for four main body areas (back, shoulder/arm, wrist, and neck). It also provides exposure scores for other MSD hazards, including driving, vibration, work pace, and stress.

The developers of QEC have categorized the exposure scores into four exposure categories: Low, Moderate, High or Very High.

	Exposure Level			
Score	**Low**	**Moderate**	**High**	**Very High**
Back (static)	8-15	16-22	23-29	29-40
Back (moving)	10-20	21-30	31-40	41-56
Shoulder/arm	10-20	21-30	31-40	41-56
Wrist/hand	10-20	21-30	31-40	41-46
Neck	4-6	8-10	12-14	16-18

For each body area, it is important to look for interactions between the scores that contribute to the exposure score for the body area. If the risk level is high or very high, it is likely that one or two factors for each body area have been given a maximum score which suggests that addressing these factors will reduce the overall risk to the body area.

Exposure scores for driving, vibration, work pace and stress have also been categorized into four exposure categories although the fourth category (Very High) is only used for stress.

	Exposure Level			
Score	**Low**	**Moderate**	**High**	**Very High**
Driving	1	4	9	-
Vibration	1	4	9	-
Work pace	1	4	9	-
Stress	1	4	9	16

The developers of the QEC method recommend that changes should be made or controls implemented if exposure scores are rated as moderate, high, or very high.

Note: while the QEC does not include a method to combine all the scores into an overall 'risk score', 'action levels' based on the 'total QEC score' have been suggested:

If manual handling is required by the worker:

Sum of all scores:	Action Suggested
Less than70	Acceptable
70 – 88	Investigate further
89 – 123	Investigate further and change soon
Greater than 123	Investigate and change immediately

If manual handling is not required by the worker:

Sum of all scores:	Action Suggested
Less than 65	Acceptable
65 – 81	Investigate further
82 – 113	Investigate further and change soon
Greater than 113	Investigate and change immediately

Limitations:

The method only allows for looking at the 'worst' task and, for each body area, the part of the task when the body area is most heavily loaded. The user must use judgment in selecting tasks to assess and deciding when the body part is most heavily loaded.

Hand force and weight of objects handled is determined by the worker even though they may not adequately understand how to estimate or determine these levels.

The cumulative effects of all activities performed during a job/task are not considered.

As with most risk assessment methods, a general risk level is provided but it cannot predict injuries to individual operators.

As with most risk assessment methods, this method does not account for individual risk factors including gender, age, or medical history.

Originally published in

Li, G. and Buckle, P. 1999, Evaluating change in exposure to risk for musculoskeletal disorders - a practical tool. Suffolk, HSE Books CRR251

For more information see

QEC Worksheet:
- http://www.surreyergonomics.org.uk/images/stories/Research/QEC/qec.pdf

QEC software program:
- http://www.geocities.com/qecuk/QEC2003.zip

Robens Centre for Health Ergonomics
- http://www.surreyergonomics.org.uk/index.php?option=com_content&task=view&id=5&Itemid=7

Further development of the usability and validity of the Quick Exposure Check (QEC):
Includes the QEC Reference Guide (**important download for those using this method**)
- http://www.hse.gov.uk/research/rrpdf/rr211.pdf

Various documents and pages, including the original 'User Guide" for QEC
- http://www.sunderland.ac.uk/~ts0gli/QEC.html

Chapter 6, Handbook of Human Factors and Ergonomics Methods, in Stanton, N. et al. (eds.) (2004) (includes original 'User Guide' for QEC)
- obtain this book through interlibrary loan at local public, college or university library.

QEC Evaluation Guide, Commission de la santé et de la sécurité du travail, Quebec (French)
- http://www.csst.qc.ca/portail/fr/publications/DC_200_698.htm

Combined / Whole Body Risk Assessment Methods
Rapid Entire Body Assessment

Full Name:

Rapid entire body assessment (REBA)

Overview/ Purpose:

REBA is a method designed to be a quick postural analysis method for whole body activities, both static and dynamic). REBA is similar in design to RULA, providing an objective measure of the MSD risk caused by tasks but it allows for assessment of tasks that are less sedentary and involve the whole body.

Body Parts Assessed:

Wrists, forearms, elbows, shoulders, neck, trunk, back, legs and knees.

Types of Jobs/Tasks:

This method was specifically developed to be useful for assessing MSD risks/working postures found in healthcare and other service industries. However, it can be used to assess a variety of tasks, in any setting, where:

- the whole body is being used
- the posture is static, dynamic, rapidly changing, or unstable, or
- animate or inanimate loads are being handled either frequently or infrequently.

See the limitations for use of this method below.

Work Settings:

This method should be useful in any work setting for tasks as described above.

MSD Hazards Considered:

Force: ☑ Posture: ☑ Repetition: ☑ Duration: ☑ Other: ☐

Brief Description of Method Process:

The REBA method is an observational method, where the user must view the task being performed and then, as with RULA, score the postures/demands required by the task activities. The developers of REBA suggest that the user should take pictures and/or video of the task.

To do a complete REBA analysis, the user needs to decide which postures/parts of the work cycle need to be assessed. To do this it is important for the user to look at the postures used over a full task cycle and, ideally, to watch the task being performed a number of times.

The user decides which postures to analyze by considering:

- What are the most frequently repeated postures?
- What postures are held for the longest amount of time (static postures)?
- What posture requires the most amount of muscular activity or requires the exertion of the highest levels of force?
- What postures are known to cause the workers discomfort?
- Are any postures considered to be extreme (very awkward) or unstable, especially if forces are exerted?

- Can any of the postures be improved through effective controls?

If necessary, the user should repeat this process for each side of the body:

- Score the trunk position (lumbar spine/trunk posture), neck posture, and leg posture, adjusting the score for more extreme postures.

- Score the position of the upper arm(s) (shoulder posture), lower arm (elbow posture), and wrist, adjusting the score for more extreme postures.

- Determine the score for force/load by considering the amount of force or load that is exerted/handled by the worker.
- Determine the score for muscle use.
- Consider how well the worker can grasp the object(s) being handled and use this information to determine a score for 'coupling'.

- Using the scores for the trunk, neck and legs determine the 'Group A' score from Table A on a REBA worksheet.
- Using the scores for the upper arm, lower arm, and wrist determine the 'Group B' score from Table B on a REBA worksheet.

- Use the REBA score sheet to combine Group A and Load/Force scores into 'Score A', and to combine Group B and Coupling scores into 'Score B'.
- Use Table C on a REBA worksheet to determine a combined 'Score C'.
- Add Score C with the muscle use/activity score to come up with the final REBA score.

Equipment Required:

A weigh scale, push/pull force gauge, and/or a hand grip/pinch grip force gauge are recommended to measure the forces/loads required for the task. If this equipment is not available it may be adequate to have the workers performing the task estimate the force/load levels.

As suggested by the developers of the method a camera and/or video camera can be helpful but are not necessary. A stopwatch may also be used but is not required.

Interpreting Results:

As noted above, the REBA method needs to be applied separately to both the left and right sides of the body. For each analysis, REBA determines a final score that represents a level of risk for the workers.

Like RULA, REBA does not have a method for combining the scores from a left and right side assessment.

The creators of the REBA method provide a series of 'action levels' based on the final score.

- Final score of 1: the risk level is 'negligible' and no action is considered necessary (Action Level = 0)
- Final score of 2 - 3: the risk level is 'low' and further action may be needed if it is indicated by other information (Action Level = 1)
- Final score of 4 - 7: the risk level is 'medium' and further action is considered to be 'necessary' (Action Level = 2)
- Final score of 8 – 10: the risk level is 'high' and further action is considered to be necessary soon (Action Level = 3)

- Final score of 11 - 15: the risk level is 'very high' and further action is considered to be necessary 'now' (Action Level = 4)

Limitations:

This method is not recommended for assessing tasks that are primarily manual material handling tasks.

While considering forces and activity, the REBA method focused primarily on work postures.

This method does not consider the duration of activity, the recovery period or vibration.

The method is not suitable for assessing jobs that involve a number of different and varying tasks.

The method only allows for the separate assessment of right- and left-hand sides of the body, and there is no method to combine these scores into a total body risk score.

The method only allows for looking at either one point of time or at the 'worst' postures observed for a task. The user must use their judgment to decide on/select representative postures (a representative snapshot) of the task.

The cumulative effects of all activities performed during a job/task are not considered.

If the job/task involves unusual, difficult to categorize, or unobservable (due to product schedules, tasks required for maintenance or start-up/shut-down, etc.) the risk associated with the job/task may not be adequately reflected by the result of the method.

This method does not consider the total duration of the task, available recovery time or vibration.

As with most risk assessment methods, a general risk level is provided but it cannot predict injuries to individual operators.

As with most risk assessment methods, this method does not account for individual risk factors including gender, age, or medical history.

Originally published in

Hignett S, and McAtamney L. "Rapid Entire Body Assessment (REBA), Applied Ergonomics, 2000, 31(1): 201-205.

For more information see

General Information on REBA Method (including worksheets):
- http://www.humanics-es.com/bernard/REBA_M11.pdf
- http://ergo.human.cornell.edu/ahREBA.html

Chapter 8, Handbook of Human Factors and Ergonomics Methods, in Stanton, N. et al. (eds.) (2004)
- obtain this book through interlibrary loan at local public, college or university library.

Combined / Whole Body Risk Assessment Methods (Continued)

ManTRA

ManTRA was designed as a method for assessing the exposure to musculoskeletal hazards associated with manual tasks in a workplace. The developers of the method recommend that the assessment should be undertaken by a team including employees who perform the task and health and safety staff.

The physical risk component of the tool combines information about the total time a worker performs the task in a typical day (exposure) and the typical time the task is performed without a break (duration). The method considers four body regions, and for each body region five variables are recorded (cycle time, force, speed, awkwardness and vibration). The method requires the user to look at the variables for the task as a whole, rather than for individual task elements.

The user must make judgments regarding the severity of each variable, at each region of the body, for the task as a whole.

The results for each variable are combined to provide an assessment of the exposure to each of the hazards considered by the method. The hazards are assessed independently for each body region because a task only needs to overload one body part to cause injury. A maximum score for exertion for any body region, or a high combined exertion and awkwardness score, indicates a high risk of acute injury; while a high risk of MSD is indicated by the presence of multiple hazards for a particular body region. Suggested thresholds are provided to aid the user in making judgments about the need for action.

For more information see:

- http://ergonomics.uq.edu.au/download/mantra2.pdf

- http://ergo.human.cornell.edu/cumantra2.htm

OWAS

OWAS is a method for evaluating postural loads that can result from job tasks. It is based on a simple and systematic coding system to classify work postures combined with observations of work tasks.

The OWAS method categorizes postures of four major body parts: trunk, arms, legs, and head/neck. The method allows for coding of three sets of static body postures and one dynamic. They are four back postures, three arm postures, six leg postures, and "walking" respectively. Additionally, it allows the user to estimate either the amount of weight lifted or the strength required to perform the task. The user can also record the time of the assessment and the name of the work activity being assessed.

Once trained on this tool a user can use it by simply observing workers and no interaction with the workers is required.

The data collected is compared against suggested to action categories, which determine whether some corrective action needs to be taken to reduce the risk of injury.

For more information see:

- http://ioe.engin.umich.edu/ioe567/OWAS.pdf

Software download: http://turva1.me.tut.fi/owas/

Computer Based Risk Assessment Methods

3-D Static Strength

The Michigan 3-D Static Strength Prediction Program (3D SSPP) predicts static strength requirements for tasks such as lifts, presses, pushes, and pulls. The program provides an approximate job simulation that includes posture data, force parameters and male/ female anthropometry. Output includes the percentage of men and women who have the strength to perform the described job, spinal compression forces, and data comparisons to NIOSH guidelines. The user can also consider trunk twisting and bending and add different types of hand forces. Analysis is aided by an automatic posture generation feature and three dimensional human graphic illustrations.

For more information see: http://www.engin.umich.edu/dept/ioe/3DSSPP/

4-D Watbak

4D WATBAK is a biomechanical modeling tool that calculates acute and cumulative loads at the major body joints, particularly the lumbar spine region. It can be used to estimate the risk of injury associated with a variety of occupational actions including pushing, pulling, lifting, lowering, holding, and carrying.

The model can be used to look at one-handed tasks and tasks that place unequal forces on the hands.

4-D Watbak is available as part of the Ergowatch package (4D Watbak, NIOSH Lifting Equation, Snook Tables, a Physical Demands Description (PDD) Checklist)

For more information see: http://www.escs.uwaterloo.ca/brochure.pdf

HandPak

HandPak is a software package designed to determine recommended acceptable forces and torques for a wide variety of manual, hand intensive tasks commonly found in the workplace. These guidelines will be very valuable to those interested in assessing task designs and determining the injury risk associated with tasks with different grips, postures, frequencies, durations and effort requirements. This software has been developed by integrating a large body of scientific research published in the literature.

For more information see: http://www.WipErgo.com

BakPak

The BakPak software package has been developed to allow for a comprehensive analysis of lifting and lowering tasks based on the biomechanical, physiological (metabolic) and psychophysical criteria available in the literature. The program requires a few simple measurements and provides estimates of acceptable loads based on each criterion.

For more information see: http://www.WipErgo.com