

Manual Tasks Risk Assessment Tool (ManTRA) V 2.0

R. Burgess-Limerick¹, L. Straker², C. Pollock³ and R. Egeskov⁴

¹School of Human Movement Studies, The University of Queensland, AUSTRALIA

²School of Physiotherapy, Curtin University of Technology, AUSTRALIA

³School of Psychology, Curtin University of Technology, AUSTRALIA

⁴Department of Industrial Relations, Queensland, AUSTRALIA

Address for correspondence:

Email robin@hms.uq.edu.au

Phone +61 7 3365 4718

Fax +61 7 3365 6877

School of Human Movement Studies

The University of Queensland, 4072

AUSTRALIA

<http://ergonomics.uq.edu.au/download/mantra2.pdf>

Manual Tasks Risk Assessment (ManTRA) V 2.0

This document describes the revised version of an audit tool developed by Robin Burgess-Limerick PhD CPE, School of Human Movement Studies, The University of Queensland; Roxanne Egeskov CPE, Senior Principal Advisor Ergonomics, Workplace Health and Safety Queensland; Leon Straker, PhD, School of Physiotherapy, Curtin University of Technology, and Clare Pollock, PhD, School of Psychology, Curtin University of Technology. The development of the tool was undertaken as part of a research project funded by Workcover Queensland (QComp) and the National Health and Medical Research Council through a Translational Grant in Injury.

One aim of ManTRA, as originally developed, was to assist DWHS inspectors in auditing workplaces across all industries for compliance with the Queensland Manual Tasks Advisory Standard. A second aim was to make an assessment of the exposure to musculoskeletal risk factors associated with manual tasks in the workplace. For workplace use the assessment should be undertaken by a team including employees who perform the task and staff responsible for manual task risk management.

The physical risk component of the revised tool combines information about the total time for which a person performs the task in a typical day (exposure) and the typical time for which the task is performed without break (duration) with an assessment, for each of four body regions, of five characteristics of the task (cycle time, force, speed, awkwardness and vibration). The assessment of each characteristic is for the task as a *whole*, rather than individual task elements. The assessment is for a specific person performing a task, rather than people generally. The aim is for the assessor to make a judgement regarding the severity of each characteristic of the task at each region for the task as a whole. The text which corresponds to the numeric codes is provided as a guide only.

The codes for each characteristic describing the task are then combined to assess the extent of exposure to each of the direct risk factors identified in the Queensland Manual Tasks Advisory Standard. The risk factors are assessed independently for each region because a task only needs to overload one body structure 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 cumulative injury is indicated by the presence of multiple risk factors for a particular body region. Suggested thresholds are provided to aid the user in making judgements about the need for action.

Explanations for each of the codes are provided below.

Total time

Total time refers to the total time which would be spent performing the task on a typical day. The code will be the same for each body region.

Total time

1	2	3	4	5
0-2 hours/day	2-4 hours/day	4-6 hours/day	6-8 hours/day	8-10 hours/day

Repetition

Tasks which involve short cycle time and prolonged duration are considered to be a risk factor because of the inevitable loading of the same tissues during the task. Tasks performed for a very long duration without interruption (> 2 hr) are similarly a risk, regardless of the cycle duration. Reduced risk is associated with tasks involving longer cycle times and shorter task duration. Cycle time and task duration are first assessed independently, and then a combined score for repetition is allocated.

Cycle time refers to the duration of task which is performed more than once without interruption. The cycle time code may vary between body regions. If a task is performed once only at any time without repetition then the code for cycle time is minimum (1). *Duration is defined as the typical length of time for which repetitions of the task are performed without any rest break or substantial interruption by any other task.* The duration code will be the same for all regions for any particular task. Cycle time and duration codes are combined to give an overall score for repetition using the key below.

Duration

1	2	3	4	5
< 10 minutes	10 min - 30 min	30 min - 1 hr	1 hr - 2 hr	> 2 hr

Cycle time

1	2	3	4	5
> 5 minutes	1 – 5 minute	30 s - 1 min	10 s - 30 s	< 10 s

Repetition Risk Factor

	Duration				
Cycle Time	1	2	3	4	5
1	1	1	2	3	4
2	1	2	3	4	4
3	2	3	4	4	5
4	2	3	4	5	5
5	3	4	5	5	5

Force

The exertion risk factor identified in the advisory standard has been expanded in ManTRA to separate force *per se*, from the speed of movement. Exertion in this audit tool requires an assessment of the force exerted within each region during the task relative to the maximal force which can be exerted. Note that the assessment should be made relative to the strength capability of the region rather than absolute force ie, a relatively small force may still require a “maximal” rating if exerted by a small muscle group (eg., fingers) but not if exerted by the lower limbs. The assessment of force is relative to the capability of the person performing the task. The force required should be rated independently of the duration of the exertion, that is, a short task which involves moderate force in the region is rated the same as a longer task. (Duration is a separate risk factor). *A maximum force score corresponds to the maximum force possible*, if greater force could have been exerted, the score should be reduced accordingly.

Force				
1	2	3	4	5
Minimal force		Moderate force		Maximal force

Speed

The speed of movement has been identified as a separate risk factor. The least risk arises when a task involves slow to moderately paced movements. Tasks which involve primarily static application of force in the region contribute to the risk of musculoskeletal injury. Tasks involving fast movements, and especially those involving rapid accelerations and decelerations constitute higher risks again. The assessment should be of the overall task eg., a tasks which involves mostly slow movements with some fast elements should be rated as moderately paced. However, *the code “3” is reserved for predominantly static tasks only*.

Speed

1	2	3	4	5
Slow movements	Moderately paced	Little or no movement—static posture	Fast and smooth movements	Fast, jerky movements

Exertion Risk Factor

Codes for force and speed are combined to give an overall score for exertion using the following key.

	Force				
Speed	1	2	3	4	5
1	1	1	2	3	4
2	1	2	3	4	4
3	2	3	4	4	5
4	2	3	4	5	5
5	3	4	5	5	5

Awkwardness

Awkwardness is difficult to define independently of specific joints, but typically postures which involve significant deviations from the mid range of movement constitute an increased risk of injury. Higher risk occurs when the deviation occurs in combinations, eg, trunk flexion combined with trunk rotation, or wrist extension and ulnar deviation. As before, the rating is for the task as a whole and the rating should be adjusted to reflect the proportion of time spent in postures of varying awkwardness. Here especially, the text is a guide only and judgement is required.

Awkwardness

1	2	3	4	5
All postures close to neutral	Moderate deviations from neutral in one direction only	Moderate deviations in more than one direction	Near end range of motion posture in one direction	Near end range of motion in more than one direction

Vibration

Exposure to whole body vibration in addition to other risk factors contributes to increased injury, particularly in the back and neck, and lower limbs. Peripheral vibration, on the other hand, is primarily a risk factor implicated in upper limb disorders. Consequently an assessment of the *severity of whole body vibration is requested for lower limbs, back, and neck regions*, while the *severity of peripheral vibration should be indicated for shoulder/arm and wrist/hand regions*. The rating is for the whole task and the score should be adjusted for duration of exposure as a proportion of the task.

Vibration (Whole body or Peripheral)

1	2	3	4	5
None	Minimal	Moderate amplitude	Large amplitude	Severe amplitude

Suggested thresholds for further action

After combining the force and speed codes to obtain a rating of the exertion risk factor, and combining the cycle time and duration to obtain a repetition risk, a cumulative risk score for each region should be calculated as the sum of codes for:

Total time + repetition + exertion + awkwardness + vibration

That is, the cumulative risk score is the sum of the scores in the unshaded columns. This yields a possible range of scores between 5 and 25.

One aim of the audit tool was to assist inspectors make a determination regarding compliance of a task with the Manual Tasks Advisory Standard. It was suggested that further action may be indicated if for any body region:

- *the combined risk factor for exertion is 5,*
- *the sum of exertion and awkwardness is 8 or greater; or*
- *the combined cumulative risk scores is 15 or greater*

These threshold values provide guidance in the prioritisation of tasks for control, and the profile of risk factor ratings should be utilised in provided advice regarding aspects of the task to which controls should be targeted.

Manual Tasks Risk Assessment tool (ManTRA) V 2.0 Scoring Matrix

			Task Codes							CumulativeRisk
Body Region	Total time	Duration	Cycle time	Repetition Risk	Force	Speed	Exertion Risk	Awkwardness	Vibration	
Lower Limbs										
Back										
Neck/ Shoulder										
Arm/ Wrist / Hand										

Cumulative risk is the sum of unshaded cells.

Codes

Total time				
1	2	3	4	5
0-2 hours/day	2-4 hours/day	4-6 hours/day	6-8 hours/day	> 8 hours/day
Duration of continuous performance				
1	2	3	4	5
< 10 minutes	10 min - 30 min	30 min - 1 hr	1 hr - 2 hr	> 2 hr
Cycle time				
1	2	3	4	5
> 5 minutes	1 - 5 minute	30 s - 1 min	10 s - 30 s	< 10 s
Force				
1	2	3	4	5
Minimal force		Moderate force		Maximal force
Speed				
1	2	3	4	5
Slow movements	Moderately paced	Little or no movement - static posture	Fast and smooth movements	Fast, jerky movements
Awkwardness				
1	2	3	4	5
All postures close to neutral	Moderate deviations from neutral in one direction only	Moderate deviations in more than one direction	Near end range of motion posture in one direction	Near end range of motion in more than one direction
Vibration (Whole body or Peripheral)				
1	2	3	4	5
None	Minimal	Moderate	Large amplitude	Severe amplitude

Scoring Keys for Repetition & Exertion

Scoring key for Repetition					
Cycle Time	Duration				
		1	2	3	4
1	1	1	2	3	4
2	1	2	3	4	4
3	2	3	4	4	5
4	2	3	4	5	5
5	3	4	5	5	5

Scoring key for Exertion					
Speed	Force				
		1	2	3	4
1	1	1	2	3	4
2	1	2	3	4	4
3	2	3	4	4	5
4	2	3	4	5	5
5	3	4	5	5	5

Action may be indicated if, for any region, the Exertion risk factor is 5, the sum of exertion and awkwardness is 8 or greater, or the cumulative risk is 15 or greater