

	RULA	SHARP	Snook: Wrist	Strain Index	UAW-GM
Title	Rapid Upper Limb Assessment	The Washington State SHARP Approach to Exposure Assessment	Psychophysical tables for acceptable load.	Strain index	United Auto Workers – General Motors Risk Factor Checklist
Overview	Upper limb assessment checklist tool. Intervention priority indicated	Entire body checklist assessment tool. Intervention information included.	Repetitive wrist movement assessment tool. Provides guidelines of acceptable forces and frequencies of repetitive wrist motion.	Upper limb assessment tool. Intervention information included. Correlates with the risk of developing upper extremity disorders.	Upper limb checklist tool. Useful for determining the presence of ergonomic risk factors.
Type	Risk Assessment	Checklist	Tables	Risk Assessment	Checklist
Stated Purpose	<ul style="list-style-type: none"> To evaluate exposures to postures, forces and muscle activities that have been shown to contribute to Repetitive Strain Injuries (RSIs). To assess posture, force and movement associated with tasks where the worker is seated or standing without moving about. Meant to be used as part of a broader ergonomic assessment. Karwowski et al. <i>The Occupational Ergonomics Handbook, 1999.</i> This method is especially appropriate for sedentary jobs. Li and Buckle, <i>Ergonomics, 1999.</i> 	<ul style="list-style-type: none"> To evaluate awkward postures, high hand force, highly repetitive motions, repeated impact, heavy, frequent or awkward lifting for any part of the body. Summary of Manual Handling Tools, 2003. OHSA for Healthcare in BC. 	<ul style="list-style-type: none"> To provide guidelines of acceptable forces for different types and frequencies of repetitive wrist motion. Tables assembled to include the maximum acceptable torque, isometric strength, tactile sensitivity and the number of symptoms for different task durations for different wrist motions. Continuation of Liberty Mutual studies of repetitive motions of the wrist. The purpose of this study was to develop tables to include the maximum torque, isometric strength, tactile sensitivity and the number of symptoms for tasks associated with ulnar deviation of the wrist. Snook et al. <i>International Journal of Industrial Ergonomics 1999.</i> 	<ul style="list-style-type: none"> To discriminate between jobs associated with and without upper distal extremity MSDs (primarily muscle-tendon and carpal tunnel syndrome) The purpose of this index is also to prioritize intervention efforts, and to help determine which parts of a task require change. This method is useful as a tool for follow up analysis. Marras et al. <i>Fundamentals and Assessment Tools for Occupational Ergonomics, 2006.</i> 	<ul style="list-style-type: none"> A two-page checklist for determining the presence of ergonomic risk factors associated with the upper limbs. Factors include repetitiveness, local mechanical contact stress, forceful manual exertions, awkward upper extremity posture, hand tool usage. Rapid-screening instrument for identifying the presence of risk factors.

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Body Parts Assessed		Trunk, shoulders, <i>arms</i>	Back, legs, <i>arms, hands, neck</i>	Back, trunk, shoulders, legs <i>wrists, hands</i>	<i>Distal upper limb</i>	<i>Hands, wrists, forearms, elbows, shoulders, neck, trunk, back ,legs, knees</i>	
Measurement of Risk Factors	Force	<ul style="list-style-type: none"> Assesses force and load that most reflects worker’s working situation. Choices include no resistance or less than 2 kg intermittent load or force; 2-10 kg intermittent load or force 2-10 kg static load or 2-10 kg repeated loads or forces or 10 kg or more intermittent load or force; 10 kg static load or 10 kg repeated loads or forces or shock or forces with rapid buildup . 	<ul style="list-style-type: none"> The pinch force required to support an object with both hands is evaluated. The grip force to support and object with one hand is evaluated. The weight of an object lifted is measured and compared with a lifting limit calculated for each lift. If the same motion is repeated with little or no variation every few seconds a hazard may exist. This hazard becomes greater if forceful exertions of the hand are required. 	<ul style="list-style-type: none"> The maximum acceptable forces for wrist flexion (power grip), wrist flexion (pinch grip) and wrist extension (power grip) at varying repetition rates were determined for various body sizes (10th to 90th percentile). 	<ul style="list-style-type: none"> The intensity of exertion measures the force using one of three methods: <ul style="list-style-type: none"> %MS is the percent of maximum strength. The Borg Scale is a qualitative assessment of force using a range of 1 to 10. The perceived effort is another quantitative measurement that uses statements to quantify the force: Statements vary from barely noticed or relaxed effort to substantial effort; changes facial expression. Intensity of exertion estimates the strength required to perform a task. Appendix A. A User’s Guide to the Strain Index. From the Assessment Tools binder. 	<ul style="list-style-type: none"> Measurement of the force of lifting, carrying, pushing or pulling is only considered if it is above 4.5 kg. The force of the grip required is considered if it involves an object or tool with a smooth slippery surface. The force on fingers or thumbs is considered if they are pressing or pushing a tool. The additional force required if gloves are worn is considered. The force due to holding a part or tool weighing more than 2.7 kg is considered. 	
				<ul style="list-style-type: none"> The maximum acceptable force for ulnar deviation at varying repetition rates for various body sizes (10th to 90th percentile). Snook et al. International Journal of Industrial Ergonomics 1999. 			<ul style="list-style-type: none"> The maximum acceptable force for a handgrip (power grip) at varying repetition rates for various body sizes was measured as well as all of the above. Ciriello et al. Ergonomics 2001.

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	Posture	<ul style="list-style-type: none"> Assessed by checking off the posture most applicable to the task. RULA looks at the upper arm, lower arm, wrist, wrist twist, neck, neck twist, neck side bend, trunk, trunk twist, trunk side bend and legs. 	<ul style="list-style-type: none"> The posture of the hands is considered by determining if they're raised above the head or if the elbows are raised above the shoulders. The posture of the wrists is evaluated. The distance that objects are held from the body is evaluated. The neck angle is considered. The back posture is measured including whether or not the posture is supported. The workers leg position is measured, depending on whether the worker squats or kneels. 	<ul style="list-style-type: none"> Force generated by different wrist postures was determined. Wrist flexion in a power grip and a pinch grip and wrist extension in a power grip were analyzed. 	<ul style="list-style-type: none"> The wrist extension, wrist flexion, and ulnar deviation is measured using qualitative values ranging from very good to fair to very bad. Appendix A. A User's Guide to the Strain Index. 	<ul style="list-style-type: none"> Postures that are considered include the use of a pinch grip, wrist deviation, twisting, rotating or screwing motion of the forearm, reaching down or behind the torso and the use of the elbow at or above the mid-torso level. 	
	Time	<ul style="list-style-type: none"> Muscle use score incorporates time values into the equation. Use is rated depending on whether the posture is static (held for more than 1 minute) or repeated more than 4 times per minute. 	<ul style="list-style-type: none"> The total time per day that hands are raised above the head is measured. The total time that the neck is at an angle of more than 45° or it is bent forward more than 30° without support is measured. The length of time a back posture is held without support or without the ability to vary the 	<ul style="list-style-type: none"> Force generated by wrist in a posture of ulnar deviation. Snook et al. International Journal of Industrial Ergonomics 1999. Force generated for a handgrip (power grip). Ciriello et al. Ergonomics 2001. 	<ul style="list-style-type: none"> Force generated for a handgrip (power grip). Ciriello et al. Ergonomics 2001. 	<ul style="list-style-type: none"> The repetition rate varied from 2 repetitions per minute to 20 repetitions for times ranging from 0 to 7 hours. The maximum acceptable torque was also measured at a rate of 15 motions per minute over a seven hour period. 	<ul style="list-style-type: none"> Duration of exertion (% of the time exertion was applied per cycle) is calculated by measuring the duration of exertion during an observation period and dividing the measured duration of exertion by the total observation time. Duration per day (% of the time exertion was applied per cycle) is calculated by measuring the

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				<ul style="list-style-type: none"> The repetition rate varied from 15 repetitions per minute to 25 repetitions. The time that motions were repeated for varied from 0 hours to 7 hours. Snook et al. International Journal of Industrial Ergonomics 1999. 		
				<ul style="list-style-type: none"> The repetition rate varied from 15 repetitions per minutes to 25. Motions were repeated for up to 7 hours. Ciriello et al. Ergonomics 2001. 		
	Other	<ul style="list-style-type: none"> Hand/finger actions considered by adding additional points to the score for pounding, gripping, exerting a force, stretching, twisting, pinch grip, handle size, shape, gloves, the height of work point and the perceived discomfort. . Karwowski et al. The Occupational Ergonomics Handbook, 1999. 	<ul style="list-style-type: none"> Repeated impact with the hand or knee is evaluated. The vibration of the tool is evaluated. 	<ul style="list-style-type: none"> The maximum acceptable torque and isometric strength were determined for each type of grip. The number and type of symptoms associated with testing was recorded. The tactile sensitivity was determined for varying repetition rates. 		<ul style="list-style-type: none"> Repetitiveness of work is qualitatively evaluated. Repetitive work is considered work that is less than 30s or if the hands repeat the same motions/exertions for more than 1/2 of the work cycle. The mechanical stress is determined by determining if there is any localized pressure as a result of the work that puts pressure on the fingers, palm or base of the hand, the forearm, elbow or armpit. As well, the use of the hand as a striking tool is considered. Vibration transmitted to the hand is considered, whether cold exhaust air blows on the hand or wrist, whether a finger is used in a rapid triggering motion, whether the object or tool is balanced and whether the object or tool jerks in the hand.
				<ul style="list-style-type: none"> The maximum acceptable torque and isometric strength were determined for ulnar deviation. The number and type of symptoms associated with testing was recorded. The tactile sensitivity was determined for varying repetition rates. Snook et al. International Journal of Industrial Ergonomics 1999. 		

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Evaluation of Single Risk Factors	Force	<ul style="list-style-type: none"> Forces rated 2 kg intermittent load or force that gives a score of zero; 2-10 kg intermittent load or force (score=1); 2-10 kg static load or 2-10 kg repeated loads or forces or 10 kg or more intermittent load or force (Score=2); 10 kg static load or 10 kg repeated loads or forces or shock or forces with rapid buildup (Score=3). 	<ul style="list-style-type: none"> The pinch force or grip force required to support an object one hand or two is evaluated and determined to be hazardous or requiring caution depending on the weight involved and the amount of time required. The weight of an object lifted is measured and compared with a lifting limit calculated for each lift. The lift is rated as hazardous or requiring caution. 	<ul style="list-style-type: none"> The grip strength depends on the percentile of the population and the repetition rate. This is used to determine the maximum acceptable force for wrist flexion and wrist extension. Anything below this force is rated as acceptable, anything above is not. The maximum acceptable force and maximum acceptable load varied depending on the rate of repetition, the number of hours of repetition and the percentile of the population. The maximum acceptable force for ulnar deviation can be determined. Any force below this is acceptable; anything above poses a greater risk. Snook et al. International Journal of Industrial Ergonomics 1999. Maximum acceptable torque, and load varied depending on the rate of repetition, the number of hours of repetition and the percentile of the population. The maximum acceptable force for a handgrip with a power grip was determined. Any force below this is acceptable; anything above poses a greater risk. The maximum acceptable torque and isometric strength were determined for a handgrip with a power grip. Ciriello et al. Ergonomics 2001. 	<ul style="list-style-type: none"> Intensity of exertion is rated. Values range from light intensity to near maximal and are assessed as percent of the maximal strength and using the Borg Scale. A rating value corresponds to the intensity of exertion. This value corresponds to a multiplier. Appendix A. A User’s Guide to the Strain Index. From the Assessment Tools binder. 	<ul style="list-style-type: none"> Factors such as mechanical stress and force are rated with a yes, or no depending on whether the operator experiences these things.

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	Posture	<ul style="list-style-type: none"> Points are added if the posture is held for longer than 1 minute or repeated more than 4 times per minute Depending of the posture checked RULA assigns a value to the scorecard. 	<ul style="list-style-type: none"> The posture of the hands is rated as hazardous or requiring caution depending on the position. The neck angle is evaluated. If the neck angle is more than 30° without support, the posture requires caution, if the angle is more than 45° the posture is hazardous. If the back is bent forward more than 30° without support or the ability to vary position, the posture may be hazardous or requiring caution. If a worker must squat or kneel, the posture may be hazardous or require caution. 		<ul style="list-style-type: none"> The qualitative wrist extension, wrist flexion and ulnar deviation rating corresponds to a numerical value that indicates a multiplier value. 	<ul style="list-style-type: none"> The posture is rated depending on whether it is experienced for more than 1/3 of the cycle, some or none of the cycle.
	Time		<ul style="list-style-type: none"> If the total time that a risky posture is maintained throughout the day is above 4 hours, the posture is considered hazardous, while greater than 2 hours per day indicates the posture requires caution. The following constitute risky postures: <ul style="list-style-type: none"> Hands raised above the head or elbows raised above the shoulders. The neck is bent at an angle of more than 30° without support or the ability to vary position. Squatting or kneeling. Maintaining a pinch or grip. Any motion repeated for more than 6 hours per day is hazardous. Motions involving forceful exertions for more than 2 hours per day are hazardous. Repeated impact with the hand or knee for more than 2 hours per day is hazardous. The number of repetitions per minute and the total per day is considered. 		<ul style="list-style-type: none"> Duration of exertion, efforts/minute, speed of work and duration per day are each given a rating value of 1 to 5. Multipliers correspond to the rating value for each task variable. 	<ul style="list-style-type: none"> Repetitiveness is rated as yes or no depending on whether or not the operator experiences these things.

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	Other		<ul style="list-style-type: none"> The vibration rate is compared to a set limit and determined to be okay, requiring caution or hazardous. Repeated impact with the hand or knee is evaluated. 	<ul style="list-style-type: none"> The tactile sensitivity was determined for varying repetition rates. Ciriello et al. Ergonomics 2001. 		<ul style="list-style-type: none"> Risk factors are rated for the left and right hand independently.
Evaluation of Combined Risk Factors		<ul style="list-style-type: none"> The total upper limb and neck/trunk/leg posture are combined to give the final score. This value is associated with a particular level of intervention priority as proposed by RULA. 	<ul style="list-style-type: none"> The lifting rating combines the posture of the lift, the object's weight, the frequency and duration of the lifts. The vibration rating combines the tools vibration acceleration in m/s² and the duration of use. 		<ul style="list-style-type: none"> The multipliers for each task are multiplicatively combined to determine the SI score. Appendix A. A User's Guide to the Strain Index. 	<ul style="list-style-type: none"> The sum of postures, forces and other risk factors held for greater than a 1/3 and greater than 2/3 of the cycle are summed separately and form a score for the job.
Validity		<ul style="list-style-type: none"> Validation and reliability studies carried out to determine whether RULA assessments give a good indication of whether loading might cause pains, aches or discomfort. RULA scores were related to the development of pain for the neck and lower arm but not for the trunk, upper arm or wrist. 			<ul style="list-style-type: none"> High sensitivity, index correctly identified jobs associated with morbidity and those not associated with morbidity. Marras et al. Fundamentals and Assessment Tools for Occupational Ergonomics, 2006. 	
Limit or Guideline Level Proposed?		<ul style="list-style-type: none"> A risk score between 1 and 7 is determined. Higher scores indicate higher risk levels and a higher urgency of intervention. The scoring generates an action list indicating the levels of intervention required to reduce the risks of injury. This assessment method is intended to be used as part of a broader ergonomic study. 	<ul style="list-style-type: none"> The lifting rating compares the weight of the object being lifted to the maximum weight limit of an object being lifted in the same manner. If these numbers are different, suggested improvements are provided. The vibration rating compares the vibration of the tool to the recommended vibration. If the vibration does not fall into an acceptable category, the process must be improved. 	<ul style="list-style-type: none"> Example limit: Maximum acceptable wrist extension force with a pinch grip at 20 motions per minute is 0.91 Nm. Example limit: Maximum acceptable torque at a rate of 15 motions per minute for a power grip in flexion is 2.11 Nm, maximum acceptable force is 26.0. Maximum acceptable torque for ulnar deviation is 1.96 Nm and maximum acceptable force is 14.0. Snook et al. International Journal of Industrial Ergonomics 1999. 	<ul style="list-style-type: none"> SI scores greater than 5 are associated with jobs that cause upper extremity disorders. Scores less than or equal to 3 are probably 'safe'. SI scores greater than or equal to 7 are hazardous. Appendix A. A User's Guide to the Strain Index. 	<ul style="list-style-type: none"> Using the references cited below, no guidelines or limits or guidelines were proposed. Summary of Manual Handling Tools. OHSA for Healthcare in BC, 2006.

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			<ul style="list-style-type: none"> Example limit: Maximum acceptable torque at a rate of 15 motions per minute for a hand grip with power grip for 75% of the population is 2.40 Nm, maximum acceptable force is 16 N. Ciriello et al. Ergonomics 2001. 		
<p>Study Base/ Generalizability Used in: Developed in:</p>	<ul style="list-style-type: none"> Investigated exposure of individuals to risk factors and associated upper limb disorders. Garment-making industry, VDU operators and a variety of other manufacturing tasks with possible risk factors present were studied. 16 experienced operators performed data entry tasks in two working postures to determine the relationship between pain development and the RULA score 	<ul style="list-style-type: none"> Health assessments and exposure assessments collected from workers at 13 worksites at baseline and 4 month intervals over 3 years. Marras et al. Fundamentals and Assessment Tools for Occupational Ergonomics, 2006 	<ul style="list-style-type: none"> Based on a sample size of 15 people. 16 female workers from the 10th percentile to the 90th percentile. Snook et al. International Journal of Industrial Ergonomics 1999. 31 women recruited by newspaper advertisement. Ciriello et al. Ergonomics 2001. 	<ul style="list-style-type: none"> One pork processing plant 14 participants and 15 evaluators assessed task alone and in 5 teams of 3 evaluators. Stephen et al. Applied Ergonomics, 2006. 	<ul style="list-style-type: none"> 335 jobs in an engine plant, metal stamping plant, and two parts distribution warehouses.
<p>Equipment Required</p>	<ul style="list-style-type: none"> No special equipment is required. Only need RULA forms and tables and visually inspect the job. Goniometers can be used to get more accurate posture measurements. Camera, weight scale and stopwatch are ideal but not necessary. 		<ul style="list-style-type: none"> Force gauge, stopwatch 	<ul style="list-style-type: none"> Camera and stopwatch ideal but not necessary. Marras et al. Fundamentals and Assessment Tools for Occupational Ergonomics, 2006. 	

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Measurement Characteristics	<ul style="list-style-type: none"> It can be inconsistent across different users. 	<ul style="list-style-type: none"> Measurements taken are mostly qualitative. Inter-rater reliability has the chance of varying widely from assessor to assessor. 		<ul style="list-style-type: none"> Tool requires qualitative inputs for three input variables, no quantitative alternative given. To minimize inter-rater reliability, subjective values should be reached by consensus. Marras et al. Fundamentals and Assessment Tools for Occupational Ergonomics, 2006. The correlation of test-retest reliability for different tests was 0.87 but less for Efforts per Minute and hand/wrist posture. Test-retest repeatability was 0.81 for individuals and 0.88 for teams. Stephen et al. Applied Ergonomics, 2006. 	<ul style="list-style-type: none"> Measurements taken were mostly qualitative. Workers were asked to indicate whether a hazard was present and how much of their time they spend doing that task.
Information for Intervention?	<ul style="list-style-type: none"> High scores do not necessarily mean that an intervention is required and low scores do not necessarily mean that one isn't. RULA is an assessment tool developed to detect risk factors that deserve further attention. 	<ul style="list-style-type: none"> Tasks in the hazard or caution zone require intervention. The hazard must be reduced as much as is economically feasible. Lifting that is classified as hazardous requires an intervention. Vibration that falls into the hazardous category requires intervention. 	<ul style="list-style-type: none"> No intervention information given. 	<ul style="list-style-type: none"> Address highest upper limb risk scores. Equation also allows impact of changing risk factor levels to be assessed Strain index scores: >9 indicates a hazardous job, intervention is required. Marras et al. Fundamentals and Assessment Tools for Occupational Ergonomics, 2006. 	<ul style="list-style-type: none"> Using the references cited below, no intervention information was proposed. Summary of Manual Handling Tools. OSHA for Healthcare in BC, 2006.
Limitations	<ul style="list-style-type: none"> The focus is on the upper body and trunk. The task is only considered at one point in time. RULA has very definite ranges when assessing the range of motion. For example, for the upper arm, a 20 degree flexion is given a lower score than a 21 degree flexion which leaves the assessment tool open to interpretations. This method does not consider the duration of the task, recovery time or vibration. David et al. Occupational Medicine, 2005. 	<ul style="list-style-type: none"> This checklist does not rate the severity of lifting, or posture frequency. Postures that are held for 4 hours or more per day are considered hazardous but postures held for less time than this are not considered hazardous. This method does not consider recovery time. Marras et al. Fundamentals and Assessment Tools for Occupational Ergonomics, 2006 	<ul style="list-style-type: none"> Subjective effects of work tolerance limit validity. The tables may not measure the limitations of a workers capability. 	<ul style="list-style-type: none"> Requires training of proper use Contact stresses, cold and vibration not accounted for Soft tissue compression not accounted for. Ratings for intensity of exertions, posture and speed of work are qualitative and subjective. 	<ul style="list-style-type: none"> Checklist was designed to be a sensitive screening instrument, biased towards classifying acceptable jobs as a problem then to classify hazardous jobs as acceptable.

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	<ul style="list-style-type: none"> The cumulative effects of a non-repetitive job are not considered. <p>Karwowski et al. <i>The Occupational Ergonomics Handbook</i>, 1999.</p>		<ul style="list-style-type: none"> Wrist extension only tested at one speed. Effects of different speeds of motions needs to be quantified. <p>Snook et al. <i>International Journal of Industrial Ergonomics</i> 1999.</p>	<ul style="list-style-type: none"> Only applies to distal upper extremity. Predicts spectrum of MSDs but not specific disorders. <p>Marras et al. <i>Fundamentals and Assessment Tools for Occupational Ergonomics</i>, 2006.</p>	
			<ul style="list-style-type: none"> Lower maximum acceptable torque for this study when compared with others. Subjects were rotated through the six tasks every 28 minutes. Higher maximum isometric torque with this study when compared with others when the subjects were rotated through the 6 tasks and a day by day basis. <p>Ciriello et al. <i>Ergonomics</i> 2001.</p>	<ul style="list-style-type: none"> Does not consider stresses related to localized mechanical compression. This risk factor must be considered separately. This method does not consider recovery time. <p>Appendix A. A User's Guide to the Strain Index.</p>	
Core Reference	<p>Mctamney, L. and Corlett, E. N. 1993. RULA: a survey method for the investigation of work-related upper limb disorders. <i>Applied Ergonomics</i>. 24(2): 91-99.</p>	<p>Washington State Department of Labor and Industries, Lifting Calculator, Hazard Zone Checklist, Caution Zone Checklist, Hazard Prevention, Ergonomics, Services & Resources, Evaluation Tools. Accessed May 2006. http://www.lni.wa.gov/Safety/Topics/Ergonomics/ServicesResources/Tools/default.asp</p>	<p>Snook, S., Vaillancourt, D., et al 1995. Psychophysical studies of repetitive wrist flexion and extension. <i>Ergonomics</i>. 38(7): 99 1488-1507.</p>	<p>Moore JS, Garg A. 1995. The strain index: A proposed method of analyzing jobs for risk of distal upper extremity disorders. <i>American Industrial Hygiene Association Journal</i>, 56(5): 443-458.</p>	<p>Keyserling, W., Stetson, D., et al. 1993. A checklist for evaluating ergonomic risk factors associated with upper extremity cumulative trauma disorders. <i>Ergonomics</i>. 36(7): pp 807-831.</p>

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Other References	<p>David, G. 2005. Ergonomic methods for assessing exposure to risk factors for work-related musculoskeletal disorders. <i>Occupational Medicine</i>. 55: pp 190-199.</p> <p>Humanics ErgoSystems Inc. Rapid Upper Limb Assessments. <i>Humanics Ergonomics, Encino CA</i>. Accessed May 5, 2006, http://humanics-es.com/rula-1.htm</p> <p>Karwowski, W., and Marras, W. 1999. Rapid Upper Limb Assessment (RULA) in <i>The Occupational Ergonomics Handbook</i>. pp 437 -445.</p> <p>Li, G., Buckle, P. 1999. Current techniques for assessing physical exposure to work-related musculoskeletal risks, with emphasis on posture-based methods. <i>Ergonomics</i>, 42(5): pp 674 to 695.</p> <p>RULA Worksheet. Cornell University Ergonomics Web. Accessed May 2006. http://ergo.human.cornell.edu/ahRULA.html</p>	<p>Summary of Manual Handling Tools, 2003. Occupational Health & Safety Agency for Healthcare in British Columbia. Accessed May 2006. http://www.ohsah.bc.ca/index.php?section_id=1475&#Section11</p> <p>Marras, W. , Karwowski W. (eds.) 2006. The Washington State SHARP Approach to Exposure Assessment. <i>Fundamentals and Assessment Tools for Occupational Ergonomics</i>. pp 44-1 to 44-22.</p>	<p>Ciriello, V., Snook, S., et al 2001. Psychophysical study of six hand movements. <i>Ergonomics</i>. 44(10): pp 922 to 936.</p> <p>Snook, S., Vaillancourt, D., et al 1997. Maximum Acceptable Forces for Repetitive Ulnar Deviation of the Wrist. <i>American Industrial Hygiene Journal</i>, 58: pp 509 to 517.</p> <p>Snook, S., Ciriello, V., and Webster, B. 1999. Maximum acceptable forces for repetitive wrist extension with a pinch grip. <i>International Journal of Industrial Ergonomics</i> 24: 579-590.</p> <p>Snook, S., Ciriello, V. 1991. The design of manual handling tasks: revised tables of maximum acceptable weights and forces. <i>Ergonomics</i>. 34(9): pp 1197 to 1213.</p> <p>Summary of Manual Handling Tools, 2003. Occupational Health & Safety Agency for Healthcare in British Columbia. Accessed May 2006. http://www.ohsah.bc.ca/index.php?section_id=1475&#Section11</p>	<p>Appendix A. A User’s Guide to the Strain Index.</p> <p>David, G. 2005. Ergonomic methods for assessing exposure to risk factors for work-related musculoskeletal disorders. <i>Occupational Medicine</i>. 55: pp 190-199.</p> <p>Marras, W., Karwowski W. (eds.) 2006. Assessment Tools, Upper Extremity Assessment Tools, Strain Index. <i>Fundamentals and Assessment Tools for Occupational Ergonomics</i>. pp. 34-8 to 34-9.</p> <p>Stephens, J-P., Gordon, A., et al. 2006. Test-retest repeatability of the Strain Index. <i>Applied Ergonomics</i>. 37: pp 275 to 281.</p>	<p>Summary of Manual Handling Tools, 2003. Occupational Health & Safety Agency for Healthcare in British Columbia. Accessed May 2006. http://www.ohsah.bc.ca/index.php?section_id=1475&#Section11</p> <p>Keyserling, W., Brouwer M., Silverstein, B., 1992. A checklist for evaluating ergonomic risk factors resulting from awkward postures of the legs, trunk and neck. <i>International Journal of Industrial Ergonomics</i>. 9: pp 283-301.</p>
Example Worksheet	<p>Worksheet</p> <p>RULA Worksheet. Cornell University Ergonomics Web, 2006.</p>	<p>Worksheet</p> <p>Marras et al. Fundamentals and Assessment Tools for Occupational Ergonomics. 2006</p>	<p>Tables</p> <p>Ciriello et al. Ergonomics 2001.</p>	<p>Worksheet</p> <p>Moore et al. American Industrial Hygiene Journal, 1995.</p>	<p>Worksheet</p> <p>Keyserling et al. Ergonomics, 1993.</p>
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