# Intelligent Ergonomics Risk Assessment

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# Rationale

- Musculoskeletal conditions are the biggest contributor to years lived with disability (YLDs) worldwide, accounting for **17%** of all YLDs worldwide. **(WH0,2022).**

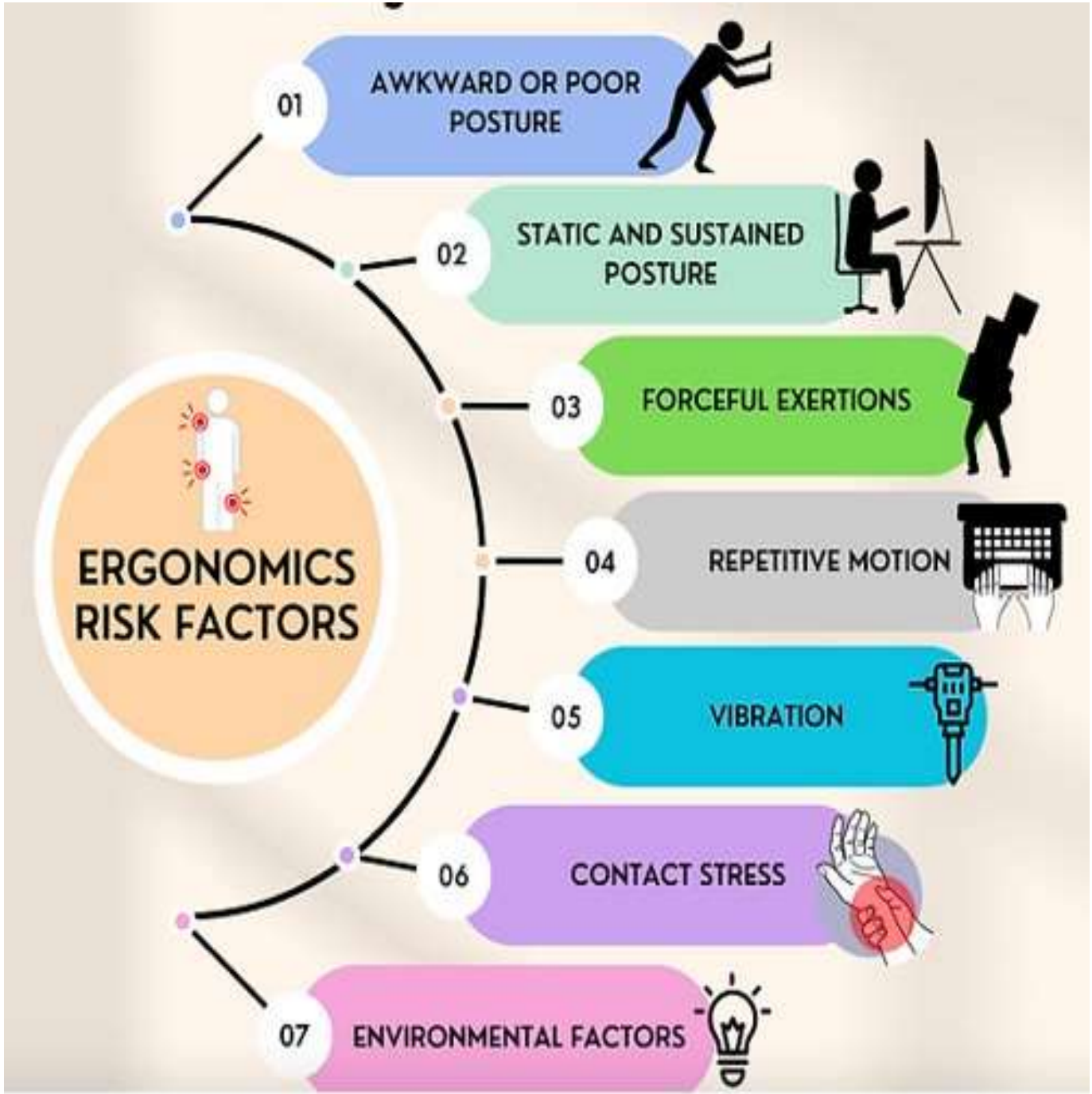
- The global incidence of musculoskeletal disorders in 2019 were 67.15% for low back pain and 14.28% for neck pain

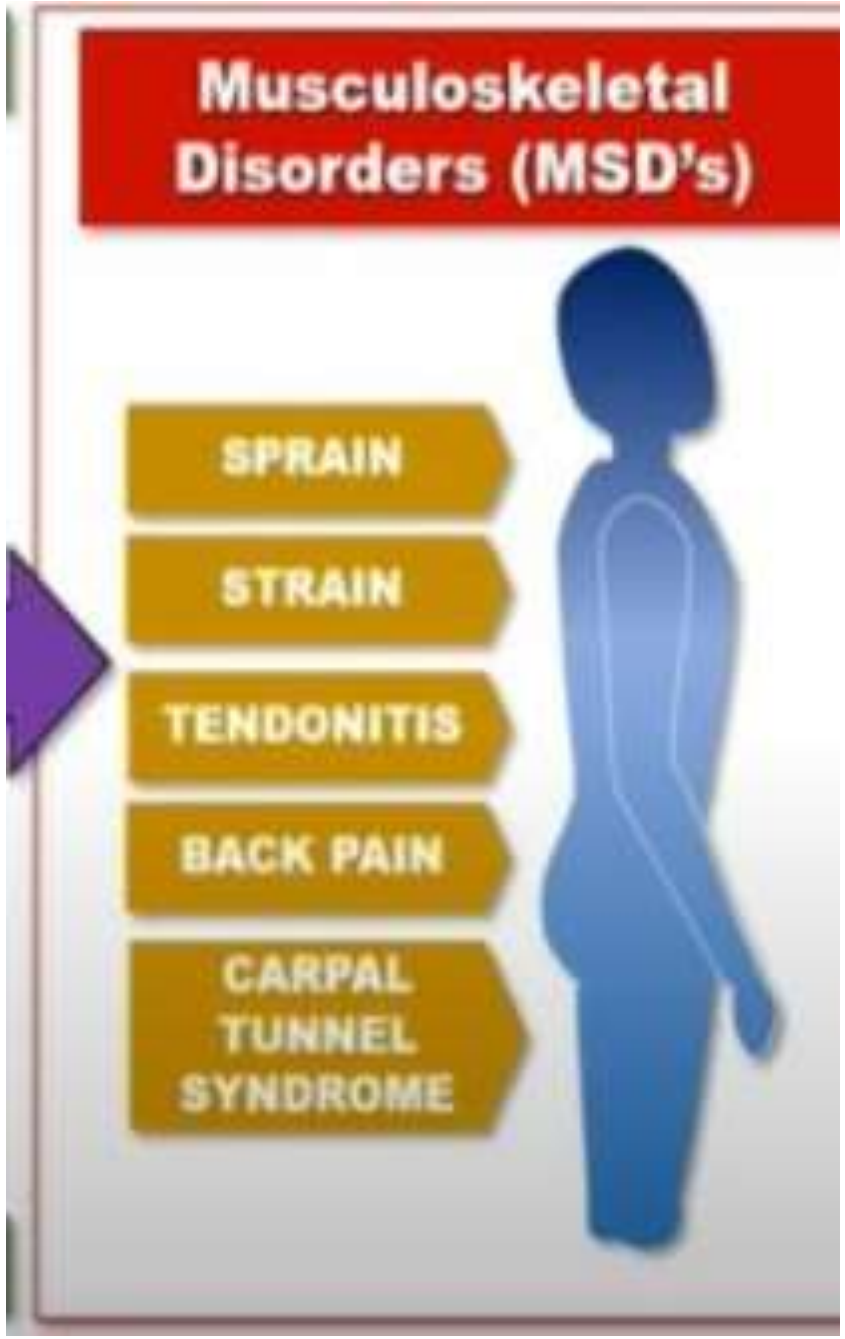
**( Lui et al.,2022).**

# Ergonomics

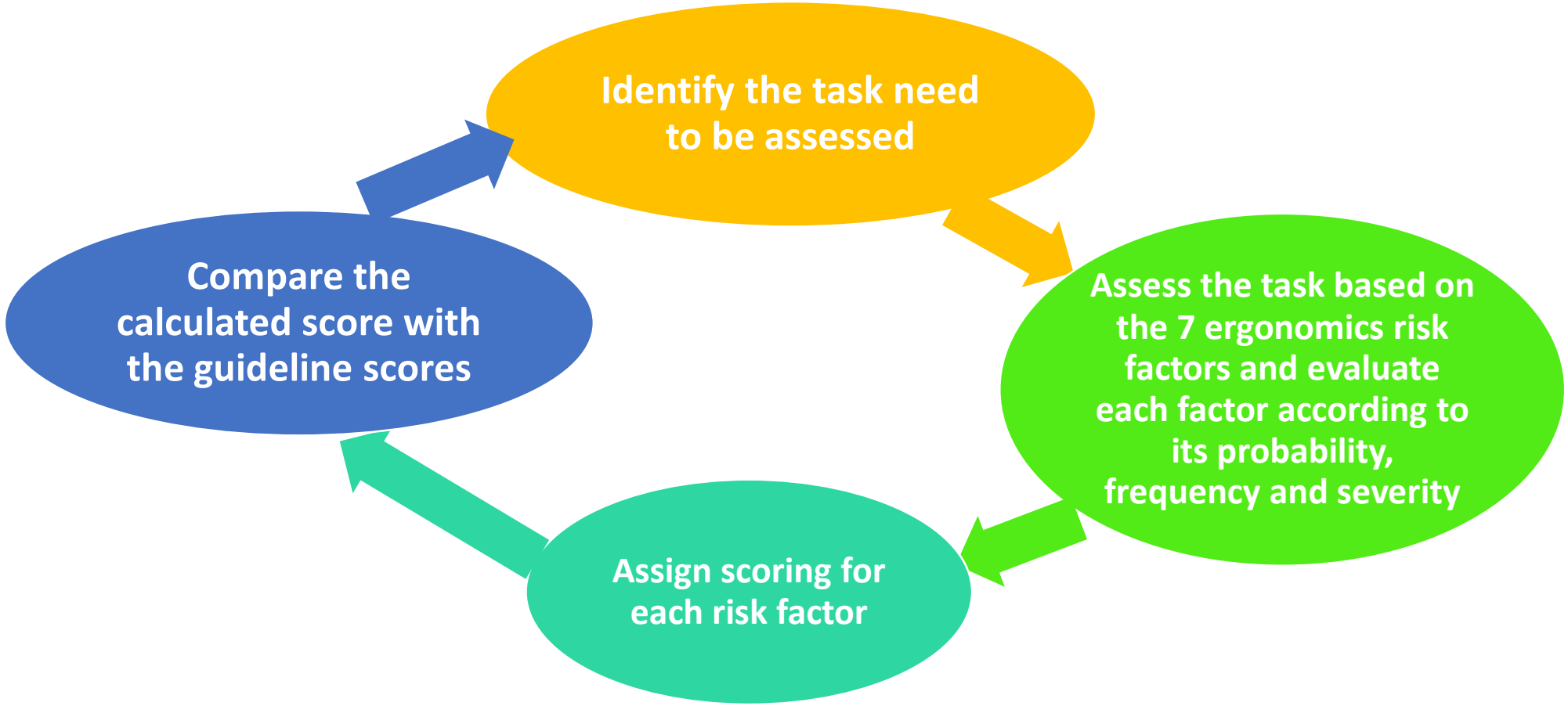
**The Occupational Safety and Health Administration (OSHA) defines ergonomics as a science of designing job to fit worker instead of forcing worker to fit job to reduce physical stress on the body and eliminate potentially harmful work-related musculoskeletal disorders**

**Initial ergonomics assessment is done by identifying the 7 ergonomics risk factors**


ERGONOMICS RISK FACTORS
01
AWKWARD OR POOR POSTURE
02
STATIC AND SUSTAINED POSTURE
03
FORCEFUL EXERTIONS
04
REPETITIVE MOTION
05
VIBRATION
06
CONTACT STRESS
07
ENVIRONMENTAL FACTORS


Musculoskeletal Disorders (MSD's)
SPRAIN
STRAIN
TENDONITIS
BACK PAIN
CARPAL TUNNEL SYNDROME

# Ergonomics risk assessment



# Ergonomics risk Evaluation

**Ergonomics risk evaluation to identify the magnitude and severity of exposure to job risk factors using different tools such as Rapid Upper Limb assessment (RULA), Rapid Entire Body Assessment (REBA) , Assessment of Repetitive Tasks (ART) and Material Handling Assessment Chart (MAC)**

# Application of Initial & Advanced ERA

Examples of ergonomic risk assessment for STAMPING job.

**1 IDENTIFY JOB**

- Identify job to be assessed.
- break the job into different tasks.

**2 INITIAL ASSESSMENT**

Identify risk factors (7 ERF) for each task.

**3 ADVANCED ASSESSMENT**

Select suitable tools & do assessment.

| TASK # 1 | TASK # 2 | TASK # 3 |
|---|---|---|
| Take parts from store | Carry parts to the machine | Operate stamping machine |
| STORE DEPT. | | STAMPING DEPT. |

| Forceful & Sustained Exertion | Awkward Posture | Repetition |
|---|---|---|
| MAC | RULA / REBA | ART |

# RAPID ENTIRE BODY ASSESSMENT

# Rapid Entire Body Assessment

## REBA Employee Assessment Worksheet

based on Technical note: Rapid Entire Body Assessment (REBA), Hignett, McAtamney, Applied Ergonomics 31 (2000) 201-205

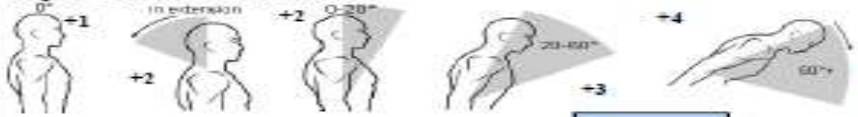
### A. Neck, Trunk and Leg Analysis

**Step 1: Locate Neck Position**


Step 1a: Adjust...
If neck is twisted: +1
If neck is side bending: +1

Neck Score

**Step 2: Locate Trunk Position**




Step 2a: Adjust...
If trunk is twisted: +1
If trunk is side bending: +1

Trunk Score

**Step 3: Legs**


Leg Score

**Step 4: Look-up Posture Score in Table A**
Using values from steps 1-3 above, locate score in Table A

Posture Score A

**Step 5: Add Force/Load Score**
If load < 11 lbs : +0
If load 11 to 22 lbs : +1
If load > 22 lbs: +2
Adjust: If shock or rapid build up of force: add +1

Force/Load Score

**Step 6: Score A, Find Row in Table C**
Add values from steps 4 & 5 to obtain Score A.
Find Row in Table C.

Score A

Scoring:
1 = negligible risk
2 or 3 = low risk, change may be needed
4 to 7 = medium risk, further investigation, change soon
8 to 10 = high risk, investigate and implement change
11+ = very high risk, implement change

### SCORES

| Table A | | Neck 1 | | | | Neck 2 | | | | Neck 3 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Legs | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| Trunk Posture Score | 1 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 3 | 3 | 5 | 6 |
| | 2 | 2 | 3 | 4 | 5 | 3 | 4 | 5 | 6 | 4 | 5 | 6 | 7 |
| | 3 | 2 | 4 | 5 | 6 | 4 | 5 | 6 | 7 | 5 | 6 | 7 | 8 |
| | 4 | 3 | 5 | 6 | 7 | 5 | 6 | 7 | 8 | 6 | 7 | 8 | 9 |
| | 5 | 4 | 6 | 7 | 8 | 6 | 7 | 8 | 9 | 7 | 8 | 9 | 9 |

| Table B | | Lower Arm 1 | | | Lower Arm 2 | | |
|---|---|---|---|---|---|---|---|
| | Wrist | 1 | 2 | 3 | 1 | 2 | 3 |
| Upper Arm Score | 1 | 1 | 2 | 2 | 1 | 2 | 3 |
| | 2 | 1 | 2 | 3 | 2 | 3 | 4 |
| | 3 | 3 | 4 | 5 | 4 | 5 | 5 |
| | 4 | 4 | 5 | 5 | 5 | 6 | 7 |
| | 5 | 6 | 7 | 8 | 7 | 8 | 8 |
| | 6 | 7 | 8 | 8 | 8 | 9 | 9 |

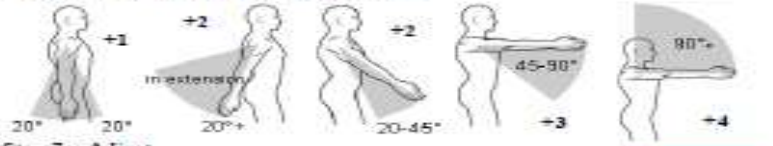
| Score A (score from table A +load/force score) | Table C: Score B (Table B value +coupling score) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 1 | 1 | 1 | 1 | 2 | 3 | 3 | 4 | 5 | 6 | 7 | 7 | 7 |
| 2 | 1 | 2 | 2 | 3 | 4 | 4 | 5 | 6 | 6 | 7 | 7 | 8 |
| 3 | 2 | 3 | 3 | 3 | 4 | 5 | 6 | 7 | 7 | 8 | 8 | 8 |
| 4 | 3 | 4 | 4 | 4 | 5 | 6 | 7 | 8 | 8 | 9 | 9 | 9 |
| 5 | 4 | 4 | 4 | 5 | 6 | 7 | 8 | 8 | 9 | 9 | 9 | 9 |
| 6 | 6 | 6 | 6 | 7 | 8 | 8 | 9 | 9 | 10 | 10 | 10 | 10 |
| 7 | 7 | 7 | 7 | 8 | 9 | 9 | 9 | 10 | 10 | 11 | 11 | 11 |
| 8 | 8 | 8 | 8 | 9 | 10 | 10 | 10 | 10 | 10 | 11 | 11 | 11 |
| 9 | 9 | 9 | 9 | 10 | 10 | 10 | 11 | 11 | 11 | 12 | 12 | 12 |
| 10 | 10 | 10 | 10 | 11 | 11 | 11 | 11 | 12 | 12 | 12 | 12 | 12 |
| 11 | 11 | 11 | 11 | 11 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

Table C Score + Activity Score

Final REBA Score

### B. Arm and Wrist Analysis

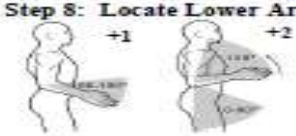
**Step 7: Locate Upper Arm Position:**




Step 7a: Adjust...
If shoulder is raised: +1
If upper arm is abducted: +1
If arm is supported or person is leaning: -1

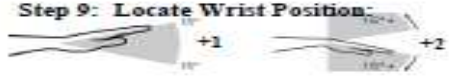
Upper Arm Score

**Step 8: Locate Lower Arm Position:**




Lower Arm Score

**Step 9: Locate Wrist Position:**




Step 9a: Adjust...
If wrist is bent from midline or twisted : Add +1

Wrist Score

**Step 10: Look-up Posture Score in Table B**
Using values from steps 7-9 above, locate score in Table B

Posture Score B

**Step 11: Add Coupling Score**
Well fitting Handle and mid rang power grip, *good: +0*
Acceptable but not ideal hand hold or coupling acceptable with another body part, *fair: +1*
Hand hold not acceptable but possible, *poor: +2*
No handles, awkward, unsafe with any body part, *Unacceptable: +3*

Coupling Score

**Step 12: Score B, Find Column in Table C**
Add values from steps 10 &11 to obtain Score B. Find column in **Table C** and match with Score A in row from step 6 to obtain Table C Score.

Score B

**Step 13: Activity Score**
+1 1 or more body parts are held for longer than 1 minute (static)
+1 Repeated small range actions (more than 4x per minute)
+1 Action causes rapid large range changes in postures or unstable base

Task name: _____ Reviewer: _____ Date: _____/_____/_____



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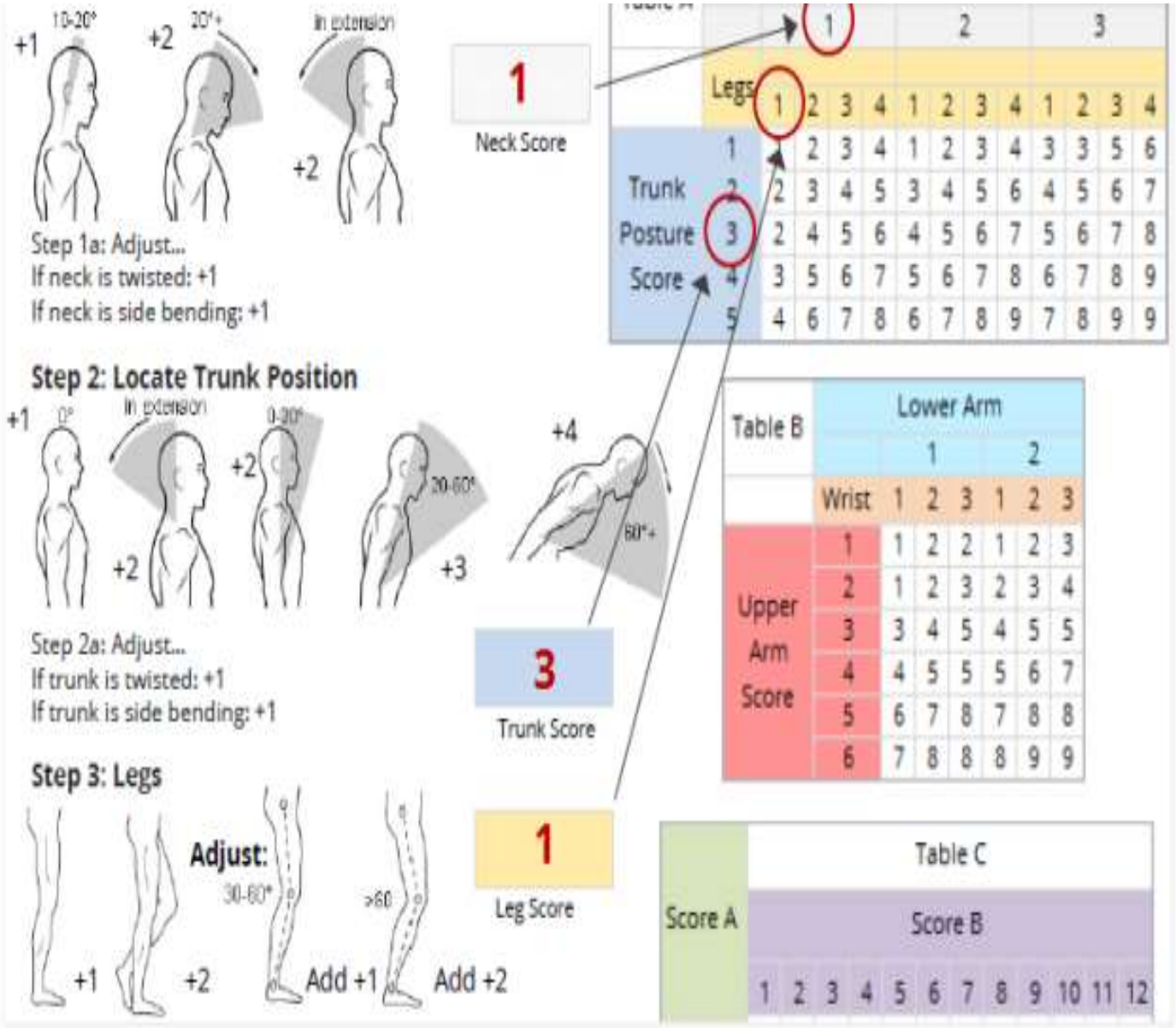
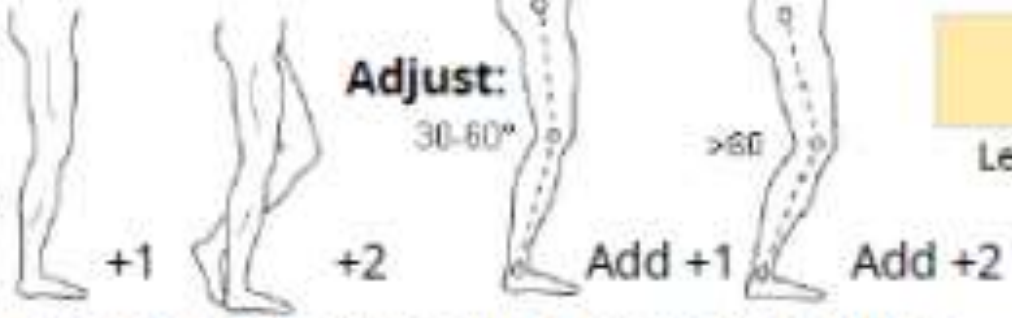
# Rapid Entire Body Assessment




**Note:** In step 2, a +2 score was used for trunk position (0-20 degrees) and +1 was




1

Leg Score

## Step 4: Look-up Posture Score in Table A

Using values from steps 1-3 above,
Locate score in Table A

2

Posture Score A

+

## Step 5: Add Force/Load Score

If load < 11 lbs. : +0
If load 11 to 22 lbs. : +1
If load > 22 lbs.: +2
Adjust: If shock or rapid build up of force: add +1

1

Force / Load Score

=

## Step 6: Score A, Find Row in Table C

Add values from steps 4 & 5 to obtain Score A.
Find Row in **Table C**.

3

Score A

### Scoring

1 = Negligible Risk
2-3 = Low Risk. Change may be needed.
4-7 = Medium Risk. Further Investigate. Change Soon.
8-10 = High Risk. Investigate and Implement Change
11+ = Very High Risk. Implement Change

**Table C**

| Score A | Score B | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 1 | 1 | 1 | 1 | 2 | 3 | 3 | 4 | 5 | 6 | 7 | 7 | 7 |
| 2 | 1 | 2 | 2 | 3 | 4 | 4 | 5 | 6 | 6 | 7 | 7 | 8 |
| 3 | 2 | 3 | 3 | 3 | 4 | 5 | 6 | 7 | 7 | 8 | 8 | 8 |
| 4 | 3 | 4 | 4 | 4 | 5 | 6 | 7 | 8 | 8 | 9 | 9 | 9 |
| 5 | 4 | 4 | 4 | 5 | 6 | 7 | 8 | 8 | 9 | 9 | 9 | 9 |
| 6 | 6 | 6 | 6 | 7 | 8 | 8 | 9 | 9 | 10 | 10 | 10 | 10 |
| 7 | 7 | 7 | 7 | 8 | 9 | 9 | 9 | 10 | 10 | 11 | 11 | 11 |
| 8 | 8 | 8 | 8 | 9 | 10 | 10 | 10 | 10 | 10 | 11 | 11 | 11 |
| 9 | 9 | 9 | 9 | 10 | 10 | 10 | 11 | 11 | 11 | 12 | 12 | 12 |
| 10 | 10 | 10 | 10 | 11 | 11 | 11 | 11 | 12 | 12 | 12 | 12 | 12 |
| 11 | 11 | 11 | 11 | 11 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

Table C Score + Activity Score = REBA Score

**To truly manage Occupational Health and Safety (OHS), we must apply a systems thinking approach with a holistic view of all risk factors**

**But**

**We can't be everywhere at once to track every pattern or recall every detail.**


Ergonomic Artificial intelligence
(AI) is recommended

# 1. AI-Driven Posture Correction

- AI-powered cameras and sensors to monitor and correct posture in real-time.
- An AI-equipped camera tracks workers posture and movements. If it detects any deviations from proper ergonomics, such as strained neck positions, it instantly sends feedback to the worker.

# AI-powered cameras and sensors

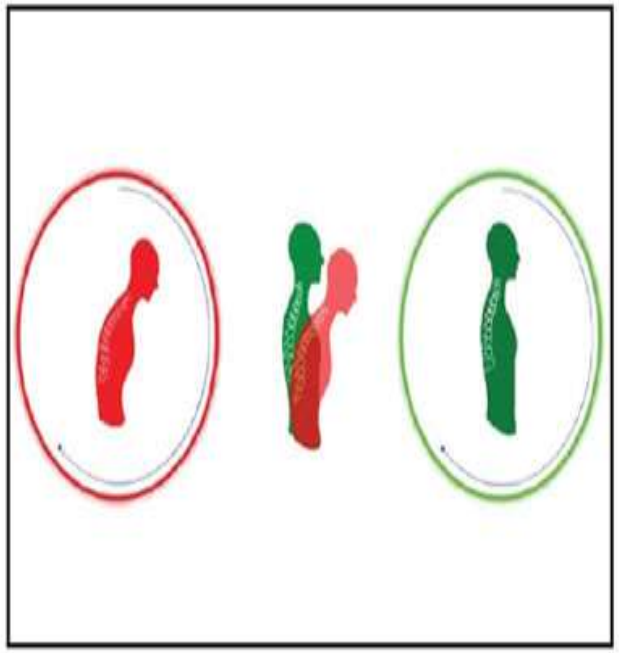
# 2. Predictive Ergonomics

- AI’s data-learning capabilities predict ergonomic issues before they become problematic
- AI analyze an individual’s work habits, movements, and workstation setup over time.
- **For instance**, if an AI system detects excessive mouse clicks or keyboard use, it may recommend short breaks or changes in workstation setup to prevent repetitive strain injuries

# 3. Wearable devices

- These devices are equipped with sensors that continuously monitor an individual’s posture and movements.

- If the device detects poor ergonomics, it provides gentle reminders to correct posture.



# 4. Virtual Reality (VR) Ergonomics

- AI-powered VR environments are being employed for ergonomic training and assessment.’
- Workers enter virtual scenarios that replicate their actual workplace.
- AI algorithms monitor their movements and provide real-time feedback on posture and ergonomics. This is particularly valuable in healthcare workers training.

Photo by Bermix Studio on Unsplas

# References


- Liu, S., Wang, B., Fan, S., Wang, Y., Zhan, Y., & Ye, D. (2022). Global burden of musculoskeletal disorders and attributable factors in 204 countries and territories: a secondary analysis of the Global Burden of Disease 2019 study. *BMJ open*, *12*(6), e062183.
- https://www.who.int/news-room/fact-sheets/detail/musculoskeletal-conditions

- https://uxplanet.org/7-ergonomics-rules-for-designing-vr-workspace-8e6f7df7261b


THANK YOU