

Human Factors Engineering
Prof. V K Tiwari
Prof. P K Ray
Agricultural and Food Engineering Department
Department of Industrial and Systems Engineering
Indian Institute of Technology, Kharagpur

Lecture - 28
Work Posture Assessment, Rapid Entire Body Assessment (REBA), MSDs/RMIs

As you already understand that during this week, we are referring to one particular topic that is called Work Posture for tasks. And for problems identification for problems removal or removal of the causes for the of the problems; obviously, you have to go for assessment.



Now today my discussion topics will be work posture assessment method known as REBA. So, this is an objective assessment which is related to the whole body. So, these are the topics I am going to discussed. Now, the first one I am going to discuss that is known as work posture say it is a part of work posture assessment and this particular technique is known as rapid entire body assessment or in short REBA.

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Work Posture Assessment: Rapid Entire Body Assessment (REBA)

- For assessment of work postures, many kinds of tools and techniques are proposed
- You need to select a technique based on relevant criterion/criteria of assessment
- Assessment tool, called REBA, is used for risk assessment: Main advantages are two-fold:
 - i. It considers psychosocial factors
 - ii. It is a participatory approach: persons rating their own jobs

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Prof. Pradipt Kumar Ray
Department of Industrial and Systems Engineering

So, there are certain steps you have to follow.

For assessment of work postures, many kinds of tools and techniques are proposed. You need to select a technique based on relevant criterion/criteria of assessment.

Assessment tool, called REBA, is used for risk assessment: Main advantages are two-fold:

- i) It considers psychosocial factors
- ii) It is a participatory approach: persons rating their own jobs

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Work Posture Assessment: Rapid Entire Body Assessment (REBA)

- **REBA is based on scientific principles and data:** it is a systematic assessment of work postures
- While a particular posture is assumed (static posture), the assessment is done on movement and position of each of the body parts, viz. Trunk, Neck, Legs, Upper Arms, Lower Arms, and Wrists
- Against each body part, movement or position is rated with score.

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Department of Industrial and Systems Engineering

And as I have already pointed out that whatever may be the job design always there is a scope for improvement. So, the REBA is based on scientific principles and data. It is a systematic assessment of work postures. While a particular posture is assumed like static postures. There could be several postures we are assuming several postures. within a work cycle and you have to just select the most the critical either one or a few work postures. Obviously, these are static posture.

The assessment is done on movement and position of each of the body parts. The position of the body part with reference to certain the reference level or the point. So, what are the body parts it focuses on are- trunk, the neck, legs, upper arms, lower arms and the wrists. So, this almost covers the entire body.

Now there are many kinds of jobs you do where they enter not only the upper part of the body, but the entire body is getting involved interacting interfacing. So, for those kinds of jobs, we will go for the REBA assessment. Against each body part movement or position is rated with the score.

There are two important aspects is what is the movement and the second one is the position.

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Work Posture Assessment: Rapid Entire Body Assessment (REBA)

- Scoring method, body part-wise, is as follows:
- **Body Part-1 Trunk: Movement: Upright-1**
 - ✓ 0° - 20° flexion or extension – 2
 - ✓ 20° - 60° flexion/ $> 20^{\circ}$ extension – 3
 - ✓ $> 60^{\circ}$ flexion – 4
- **Body part-2: Neck: Movement**
 - ✓ 0° - 20° flexion-1
 - ✓ $> 20^{\circ}$ flexion or extension - 2

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So, I will just highlight the important aspects about the rating with respect to each the criterion.

Scoring method, body part-wise, is as follows:

1. Body Part-1 Trunk: Movement: Upright-1

0° - 20° flexion or extension – 2

20° - 60° flexion/ $> 20^{\circ}$ extension – 3

$> 60^{\circ}$ flexion – 4

2. Body part-2: Neck: Movement

0° - 20° flexion-1

$> 20^{\circ}$ flexion or extension - 2

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Work Posture Assessment: Rapid Entire Body Assessment (REBA)

- **Body Part-3: Legs: Position**
 - ✓ Bilateral weight bearing, walking or sitting – 1
 - ✓ Unilateral weight bearing or unstable – 2
 - ✓ $> 60^\circ$ flexion – 4
- **Body part-4: Upper Arm : Position**
 - ✓ 20° flexion or extension – 1
 - ✓ $> 20^\circ$ extension, $20^\circ - 45^\circ$ flexion – 2
 - ✓ $45^\circ - 90^\circ$ flexion – 3
 - ✓ $> 90^\circ$ flexion – 4

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3. Body Part-3: Legs: Position

Bilateral weight bearing, walking or sitting – 1

Unilateral weight bearing or unstable – 2

$> 60^\circ$ flexion – 4

4. Body part-4: Upper Arm : Position

20° flexion or extension – 1

$> 20^\circ$ extension, $20^\circ - 45^\circ$ flexion – 2

$45^\circ - 90^\circ$ flexion – 3

$> 90^\circ$ flexion – 4

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Work Posture Assessment: Rapid Entire Body Assessment (REBA)

- **Body Part-5: Lower arms: Movement**
 - ✓ 60° - 100° flexion – 1
 - ✓ < 60° or >100° flexion– 2
- **Body part-6: Wrists : Movement**
 - ✓ 0° - 15° flexion or extension – 1
 - ✓ > 15° flexion or extension – 2

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5. Body Part-5: Lower arms: Movement

60° - 100° flexion – 1

< 60° or >100° flexion– 2

6. Body part-6: Wrists: Movement

0° - 15° flexion or extension – 1

> 15° flexion or extension – 2

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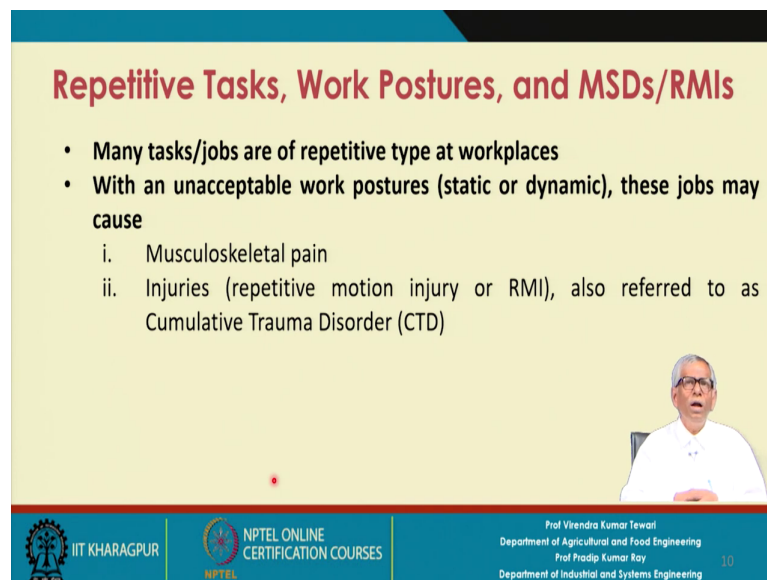
Work Posture Assessment: Rapid Entire Body Assessment (REBA)

- Against each body part, extra score may be added under twisted, laterally flexed, or other special conditions

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So, against each body part extra score may be added under twisted. It is like bending with twisting and that particular UK guidelines the manual material handling task. So, it is a twisted one recommended weight or the load can be reduced by 20%, under the twisted laterally flexed or other special conditions.

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Repetitive Tasks, Work Postures, and MSDs/RMIs

- Many tasks/jobs are of repetitive type at workplaces
- With an unacceptable work postures (static or dynamic), these jobs may cause
 - i. Musculoskeletal pain
 - ii. Injuries (repetitive motion injury or RMI), also referred to as Cumulative Trauma Disorder (CTD)

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Department of Industrial and Systems Engineering

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If you constantly assess your work postures by using REBA in all likelihood what will happen? Constantly you will be changing the work method and ultimately you get the best possible work procedures.

It happens. It might take the few months of time for one advantage is if it is 100 percent labor intensive. Now many such if the person concerned is highly motivated. And you are really highlighting the root causes and you are interacting with the persons concerned in all likelihood he or she will help you in getting it implemented. Because it will be implemented through him or her and he or she will get the benefit.

So, very quickly you can implement with their support a very good method. And then you get the reverse score; obviously, you will find that it is a better score. Many tasks/jobs are of repetitive type at workplaces

With an unacceptable work posture (static or dynamic), these jobs may cause:

1. Musculoskeletal pain

2. Injuries (repetitive motion injury or RMI), also referred to as Cumulative Trauma Disorder (CTD)

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Repetitive Tasks, Work Postures, and MSDs/RMIs

- Ergonomic design calls for assessment and minimization of MSDs/RMIs/CTDs
- Ramazzini in Italy in 1717 recognized RMI among office staff: Three causes are cited
 - i. Repetitive motions of hand
 - ii. Constrained body/work postures
 - iii. Excessive mental/physical stress

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Prof. Pradip Kumar Ray
Department of Industrial and Systems Engineering

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Ergonomic design calls for assessment and minimization of MSDs/RMIs/CTDs

Ramazzini in Italy in 1717 recognized RMI among office staff: Three causes are cited:

1. Repetitive motions of hand
2. Constrained body/work postures
3. Excessive mental/physical stress

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Repetitive Tasks, Work Postures, and MSDs/RMIs

- Injuries may develop after an extended period of time
- These injuries are very common among a high proportion of workers at workplaces across the world: estimated cost for RMIs is very high

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So, these are the three reasons and he identified and he called it RMIs repetitive motion injuries. Injuries may develop after an extended period of time. Normally the job is designed and the job in the same design continues for a long time. And obviously, if it is a bad design; obviously, there will be bad work postures and this job will continue; the injuries may develop after an extended period of time RMIs. These injuries are very common among a high proportion of workers at work places across the world. Even these days what is happening, the various kinds of RMIs MSDs are occurring even among the young working population throughout the world. New designs are coming. So, the old problems do vanish, but again with the new design with the new technology the new problems do come.

So, one problem you solve, but another arises, So, you have to improve the process. So, that is why you will find that there is a lot many cases of RMIs among the even the young personnel and estimated cost for RMIs is very high.

So; that means, when you become sick, unhealthy and it becomes a burden to the system so; obviously, you will get treatment and there will be extra cost associated with the treatment. So, the estimated cost for RMIs is very high.

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Repetitive Tasks, Work Postures, and MSDs/RMIs

- Common RMIs

Scientific Disorder Name	Popular Names
Carpal tunnel syndrome	Telegraphist's wrists
Cubital tunnel syndrome	Clothes wringing disease
De Quervain's disease	Tennis elbow
Epicondylitis	Golfer's elbow
Ganglion	Bible bump
Shoulder tendonitis	Space invader's wrist
Tendonitis	Slot-machine tendinitis
Tenosynovitis	Pizza palsy
Thoracic outlet syndrome	Trigger finger
Ulnar nerve entrapment	

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Department of Agricultural and Food Engineering
Prof. Pradip Kumar Ray
Department of Industrial and Systems Engineering

Just you keep in mind this one and what are the common RMIs? There are various scientific disorder name with their popular name. Carpal tunnel syndrome is popularly known as telegraphist's wrist. Cubital tunnel syndrome is known as clothes wringing disease. De Quervian's disease is popularly known as tennis elbow. Epicondylitis is popularly known as Golfer's elbow. Ganglion is known as Bible bump. Shoulder tendonitis is popularly known as space invader's wrist. Tendonitis is popularly known as slot machine tendinitis. Tenosynovitis is popularly known as Pizza palsy. Thoracic outlet syndrome is known as trigger finger. And there is ulnar nerve entrapment.

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Repetitive Tasks, Work Postures, and MSDs/RMIs

- **Two injuries are very common among manufacturing workers**
 - i. Carpal Tunnel Syndrome (CTS) in hand
 - Symptoms: numbness, tingling, pain, clumsiness
 - ii. **Tenosynovitis in wrist and ankle**
 - Symptoms: pain, burning sensation, swelling



Two injuries are very common among manufacturing workers. They are as follow:

i. Carpal Tunnel Syndrome (CTS) in hand

Symptoms: numbness, tingling, pain, clumsiness

ii. Tenosynovitis in wrist and ankle

Symptoms: pain, burning sensation, swelling

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Repetitive Tasks, Work Postures, and MSDs/RMIs

Type of Job	Disorder	Occupational Factors	Type of Job	Disorder	Occupational Factors
1. Buffing/striding	Tenosynovitis, thoracic outlet, carpal tunnel, De Quervain's	Repetitive wrist motions, prolonged fixed shoulders, forceful ulnar deviation, repetitive forearm pronation	6. Small parts assembly (wiring, bandage wrap)	Tension neck, thoracic outlet, wrist tendinitis, epicondylitis	Prolonged restricted posture, forceful ulnar deviation and thumb pressure, repetitive wrist motion, forceful wrist extension and pronation
2. Punch press operators	Tendinitis of wrist and shoulder	Repetitive forceful wrist extension/flexion, repetitive shoulder abduction/flexion, forearm supination	7. Bench work (glass cutters, phone operators)	Ulnar nerve entrapment	Sustained elbow flexion with pressure on ulnar groove
3. Overhead assembly (welders, painters, auto repair)	De Quervain's, thoracic outlet, shoulder tendinitis	Repetitive ulnar deviation in pushing controls, sustained hyperextension of arms, hands above shoulders	8. Packing	Tendinitis of shoulder or wrist, lesion neck, carpal tunnel, De Quervain's, Thoracic outlet	Prolonged load on shoulders, repetitive wrist motions, overextension, forceful ulnar deviation
4. Belt conveyor assembly	Tendinitis of shoulder and wrist, carpal tunnel, thoracic outlet	Arms extended, abducted, or flexed more than 60°, repetitive, forceful wrist motions	9. Truck driver	Thoracic outlet	Prolonged shoulder abduction and flexion
5. Typing, keypunch, callier	Tension neck, thoracic outlet, carpal tunnel	Static, restricted posture, arms abducted/flexed, high speed finger movement, palmar base pressure, ulnar deviation	10. Core making	Tendinitis of the wrist	Prolonged shoulder abduction and flexion, repetitive wrist motions

Along with type of job there are certain disorder and there is also occupational factor that has cause the disorders.

1. Buffering or grinding the disorder for this type of job includes tenosynovitis, thoracic outlet, De Quervian's the organisational factor includes repetitive wrist motion, long flex shoulder, forceful ulnar deviation, forearm pronation.

2. Punch press operators-tendinitis of wrist and shoulder is the disorder. Occupational factors includes repetitive forceful wrist extension or flexion, soldier abduction or flexion, forearm supination.

3. Overhead assembly for welders, painters, auto repairs- De Quervian's, thoracic outlet, shoulder tendinitis, and factors includes repetitive ulnar deviation in pushing control, sustained hyper extension of arm, and hands above shoulder.

4. Belts Conveyor assembly - disorder includes tendinitis of shoulder and wrist, carpal tunnel, thoracic outlet. Occupational factors includes arms extended, abducted or flexed more than 60 degree repetitive, forceful wrist motion.

5. Typing, Key punch, cashier - tension neck, thoracic outlet, carpal tunnel are disorder and factors includes static, restricted poster, arm abducted or flexed, High speed finger movement, palmar base pressure, ulnar deviation.

6. Small parts assembly- is order includes tension neck, thoracic outlet, wrist tendonitis, epicondylitis and factors includes prolong restricted posture, forceful ulnar deviation and thumb pressure, repetitive wrist motion, full wrist extension and pronation.

7. Bench work- disorder includes ulnar nerve entrapment, and factors includes sustained elbow flexion with pressure or ulnar groove.

8. Packing - disorder includes tendinitis of shoulder or wrist, tension neck, carpal tunnel, De Quervian's. Factors including loads on shoulder, repetitive wrist motion, overexertion, forceful ulnar deviation.

9. Truck driver-thoracic outlet is the disorder and factor includes prolong shoulder abduction and flexion.

10. Core making- disorder includes tendinitis of the wrist and factors includes prolonged shoulder abduction and flexion, repetitive wrist motion.

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The slide features a title 'Repetitive Tasks, Work Postures, and MSDs/RMIs' in red text at the top. Below the title, a bulleted list outlines the causes of RMIs. A small inset video of a speaker is visible in the bottom right corner of the slide content area. The footer contains logos for IIT Kharagpur and NPTEL, along with the names and departments of the presenters.

Repetitive Tasks, Work Postures, and MSDs/RMIs

- **Causes of RMIs:** Three main reasons
 - Inappropriate work methods**, including bad/unacceptable work postures
 - Inappropriate leisure activities** including insufficient rest period, and
 - Pre-existing health conditions**

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So, all these details are here. Now there are three main reasons of RMIs.

Inappropriate work methods: First one is the inappropriate work methods including bad unacceptable work postures.

Second one is Inappropriate leisure activities including insufficient rest period, and third one is Pre-existing health conditions.

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Repetitive Tasks, Work Postures, and MSDs/RMIs

- **Inappropriate work methods**
 - ✓ Repetitive hand movements with high force
 - ✓ Flexion and extension of hand
 - ✓ High force pinch grip
 - ✓ Uncomfortable work postures
 - ✓ Lack of experience of manual work
 - ✓ New job
 - ✓ Back from vacation

Prof. Virendra Kumar Tewari
Department of Agricultural and Food Engineering
Prof. Pradip Kumar Ray
Department of Industrial and Systems Engineering

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Inappropriate work methods include:

1. Repetitive hand movements with high force
2. Flexion and extension of hand
3. High force pinch grip
4. Uncomfortable work postures
5. Lack of experience of manual work
6. New job
7. Back from vacation

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Repetitive Tasks, Work Postures, and MSDs/RMIs

- **Inappropriate leisure activities**
 - ✓ Insufficient rest due to working in a second job
 - ✓ Knitting, playing musical instruments, playing tennis, bowling, home improvement work
- **Pre-existing conditions**
 - ✓ Arthritis, joint pain
 - ✓ Nerve damage
 - ✓ Circulatory disorders
 - ✓ Reduced estrogen level
 - ✓ Small hand/wrist size

Prof. Viendra Kumar Tewari
Department of Agricultural and Food Engineering
Prof. Pradip Kumar Ray
Department of Industrial and Systems Engineering

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Inappropriate leisure activities include Insufficient rest due to working in a second job, Knitting, playing musical instruments, playing tennis, bowling, home improvement work.

Pre-existing conditions includes Arthritis, joint pain, Nerve damage, Circulatory disorders, Reduced estrogen level, small hand/wrist size.

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List of Reference Textbooks

1. Sanders, M. S. and McCormick, E. J., Human Factors in Engineering and Design, McGraw-Hill, Sixth Edition
2. Bridger, R. S., Introduction to Ergonomics, Taylor and Francis Group, Third Edition
3. Helander M, A Guide to Human factors and Ergonomics, Taylor and Francis Group, Second Edition

Prof. Viendra Kumar Tewari
Department of Agricultural and Food Engineering
Prof. Pradip Kumar Ray
Department of Industrial and Systems Engineering

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