

# JOB STRAIN INDEX (JSI)

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## Job Strain Index (JSI)

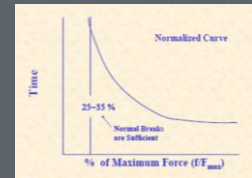
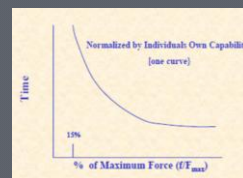
- Metode Job Strain Index (JSI) dikembangkan oleh **Dr. J.S. Moore and Dr. A. Garg**
- JSI adalah metode untuk mengestimasi resiko terjadinya kecelakaan/sakit pada pergelangan tangan (wrist), tangan (hand), dan sikut (elbow) = **Distal Upper Extremity**.
- Pengukuran JSI memberikan pengukuran cepat dan sistematis resiko postural tangan/ pergelangan tangan pekerja, baik tangan kanan maupun tangan kiri.
- Analisis dapat dilakukan sebelum dan sesudah intervensi untuk mendemonstrasikan bahwa intervensi dapat bekerja pada tingkat resiko kecelakaan terendah.

## Job Strain Index (JSI)

- Contoh aplikasi penggunaan metode JSI, tentunya dapat dilihat dari proses pengangkatan beban, pekerjaan meat packing, perakitan part berukuran kecil, keyboarding, dan pekerjaan lain yang membutuhkan banyak gerakan tangan.
- Dengan menggunakan metode ini dapat dianalisa maksimal beban yang diangkat oleh tangan, durasi kemampuan dari tangan untuk mengangkat suatu beban, dan kecepatan kerja dari tangan pada saat pengangkatan beban.

A full description of the JSI method is contained in the original journal article: Moore, J.S., and Garg, A. (1995) The Strain Index: A Proposed Method to Analyze Jobs For Risk of Distal Upper Extremity Disorders. *American Industrial Hygiene Association Journal*, 56(5): 443-456.

### A problem for evaluating strain



## JSI Ratings

- 1.Intensity of Exertion
- 2.Duration of Exertion
- 3.Efforts per Minute
- 4.Hand/Wrist Posture
- 5.Speed of Work
- 6.Duration of Task per Day

$$SI = \text{Intensity} * \text{Duration} * \text{Efforts} * \text{Posture} * \text{Speed} * \text{Duration}$$

$$SI = IE * DE * EM * HWP * SW * DD$$

## 1. Intensity of Exertion

- Estimasi kekuatan yang dibutuhkan untuk melakukan tugas pada suatu waktu.
- Standar penentuan kriteria peringkat ditampilkan pada tabel berikut ini.

## 1. Intensity of Exertion

Rating Criterion	%MS *	Borg Scale**	Perceived Effort	IE Multiplier
Light	<10%	<=2	Barely noticeable or relaxed effort	1
Somewhat Hard	10%-29%	3	Noticable or definite effort	3
Hard	30%-49%	4-5	Obvious effort; unchanged facial expression	6
Very Hard	50%-79%	6-7	Substantial effort; changes facial expression	9
Near Maximal	>=80%	>7	Uses shoulder or trunk to generate force	13

\*Percentage of maximal strength  
\*\*Compared to Borg CR-10Scale

## 2. Duration of Exertion

Duration of Exertion =  $\frac{100 \times \text{duration of all exertions(sec)}}{\text{total observation time (sec)}}$

Rating	Duration within cycle	DE Multiplier
1	< 10 %	.5
2	10 - 30 %	1
3	30 - 50 %	1.5
4	50 - 80 %	2
5	80 - 100 %	3

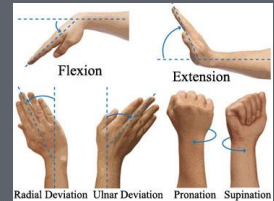
## 3. Efforts per Minute

Efforts per Minute =  $\frac{\text{number of exertions}}{\text{total observation time(min)}}$

Rating	Efforts per Minute	EM Multiplier
1	< 4	.5
2	4 - 8	1
3	9 - 14	1.5
4	15 - 19	2
5	> 19	3

## 4. Hand/Wrist Posture

- Postur tangan/pergelangan tangan adalah estimasi posisi tangan dan pergelangan tangan relatif terhadap posisi netral.
- Kategori deviasi :
  - Flexion : toward the palm of the hand
  - Extension : toward the back of the hand
  - Ulnar Deviation : toward the little finger



## 4. Hand/Wrist Posture

Rating Criterion	Wrist Extension (deg)	Wrist Flexion (deg)	Ulnar Deviation (deg)	Perceived Posture	HWP Multiplier
Very Good	0-10	0-5	0-10	Perfectly neutral	1
Good	11-25	6-15	11-15	Near neutral	1
Fair	26-40	16-30	16-20	Nonneutral	1,5
Bad	41-55	31-50	21-25	Marked deviation	2
Very Bad	>60	>50	>25	Near extreme	3

## 5. Speed of Work

- Kecepatan kerja adalah estimasi seberapa cepat pekerja tersebut bekerja.

Rating Criterion	Compared to MTM-1	Perceived Speed	SW Multiplier
Very slow	<=80%	Extremely relaxed pace	1
Slow	81-90%	Taking one's own time	1
Fair	91-100%	Normal speed of motion	1
Fast	101-115%	Rushed but able to keep up	1,5
Very fast	>115%	Rushed and barely or unable to keep up	2

## 6. Duration of Task per Day

- Durasi tugas per hari menunjukkan total waktu tugas tersebut dikerjakan dalam 1 hari.
- Durasi tugas per hari adalah diukur atau diperoleh dari personel di lapangan

Rating	Duration of Task per Day	DD Multiplier
1	< 1 hour	0,25
2	1-2 hour	0,5
3	2-4 hour	0,75
4	4-8 hour	1
5	> 8 hour	1,5

## Job Strain Index

Rating	Intensity of Exertion (IE)	Duration of Exertion (DE)	Efforts/Minute (EM)	Hand/Wrist Posture (HWP)	Speed of Work (SW)	Duration per Day (DD)
1	Light (1)	<10% (0.5)	<4 (0.5)	Very good (1)	Very slow (1)	<1 (.25)
2	Somewhat hard (3)	10-29% (1)	4-8 (1)	Good (1)	Slow (1)	1-2 (.5)
3	Hard (6)	30-49% (1.5)	9-14 (1.5)	Fair (1.5)	Fair (1)	2-4 (.75)
4	Very hard (9)	50-79% (2)	15-19 (2)	Bad (2)	Fast (1.5)	4-8 (1)
5	Near maximal (13)	80-100% (3)	>20 (3)	Very bad (3)	Very fast (2)	>8 (1.5)

$$JSI = IE \times DE \times EM \times HWP \times SW \times DD$$

Moore, J.S. and Garg, A. (1995) American Industrial Hygiene Journal 56:443-58.

## Job Strain Index Worksheet

	Intensity of Exertion (IE)	Duration of Exertion (DE)	Efforts/Minute (EM)	Hand/Wrist Posture (HWP)	Speed of Work (SW)	Duration per Day (DD)
Exposure data						
Ratings						
Multipliers						
SI Scores						

$$JSI = IE \times DE \times EM \times HWP \times SW \times DD$$

## Job Strain Index Worksheet Example

	Intensity of Exertion (IE)	Duration of Exertion (DE)	Efforts/Minute (EM)	Hand/Wrist Posture (HWP)	Speed of Work (SW)	Duration per Day (DD)
Exposure data	Somewhat hard	60%	12	fair	fair	4-8
Ratings	2	4	3	3	3	4
Multipliers	3.0	2.0	1.5	1.5	1.0	1.0

$$JSI = IE \times DE \times EM \times HWP \times SW \times DD$$

$$JSI = 3.0 \times 2.0 \times 1.5 \times 1.5 \times 1.0 \times 1.0$$

$$JSI = 13.5$$

## Strain Index (SI)

- Percobaan awal menunjukkan bahwa pekerjaan yang berhubungan dengan **distal upper extremity disorders** memiliki nilai SI lebih besar dari 5.
- Nilai SI **kurang dari atau sama dengan 3, aman**.
- Nilai SI **lebih besar atau sama dengan 7** memiliki kemungkinan **membahayakan**.
- Strain Index (SI) tidak menganggap bahwa stress berubungan dengan lokalisasi tekanan mekanik. Faktor resiko harus dianggap terpisah.

SI Score	Interpretation
< 3	Safe
3-5	Uncertain
5-7	Some risk
>7	Hazardous

## CONTOH KASUS

- Seorang mahasiswa mengendarai sepeda motor menempuh jarak 500 m selama 10 menit. Selama perjalanan, rata-rata pengendara mempercepat kendaraannya sebanyak 20 kali selama masing-masing 10 detik. Setiap harinya, mahasiswa tersebut mengendarai motor selama 2 jam.



### 1. Intensity of Exertion

Rating Criterion	%MS *	Borg Scale**	Perceived Effort	IE Multiplier
Light	<10%	<=2	Barely noticeable or relaxed effort	1
Somewhat Hard	10%-29%	3	Noticable or definite effort	3
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\*Percentage of maximal strength  
\*\*Compared to Borg CR-10Scale

### 2. Duration of Exertion

$$\text{Duration of Exertion} = \frac{100 \times 200}{600} = 33.33\%$$

Rating	Duration within cycle	DE Multiplier
1	< 10 %	.5
2	10 - 30 %	1
3	30 - 50 %	1.5
4	50 - 80 %	2
5	80 - 100 %	3

### 3. Efforts per Minute

$$\text{Efforts per Minute} = \frac{20}{10} = 2$$

Rating	Efforts per Minute	EM Multiplier
1	< 4	.5
2	4 - 8	1
3	9 - 14	1.5
4	15 - 19	2
5	> 19	3

### 4. Hand/Wrist Posture



Rating Criterion	Wrist Extension (deg)	Wrist Flexion (deg)	Ulnar Deviation (deg)	Perceived Posture	HWP Multiplier
Very Good	0-10	0-5	0-10	Perfectly neutral	1
Good	11-25	6-15	11-15	Near neutral	1
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5	> 8 hour	1.5

### Job Strain Index Worksheet

	Intensity of Exertion	Duration of Exertion (DE)	Efforts/Minute (EM)	Hand/Wrist Posture (HWP)	Speed of Work (SW)	Duration per Day (DD)
Multipliers	1	1,5	0,5	2	1	0,25

$$JSI = IE \times DE \times EM \times HWP \times SW \times DD$$

$$JSI = 1 \times 1,5 \times 0,5 \times 2 \times 1 \times 0,5 = 0,75$$

SI Score	Interpretation
< 3	Safe
3-5	Uncertain
5-7	Some risk
>7	Hazardous