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Ergonomics women's Health & safety

By

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What is Ergonomics?

- The applied science of equipment and the workplace design, that intended to maximize work productivity by reducing worker fatigue and discomfort.

- Also it is called biotechnology, human engineering, human factors engineering.

What is occupational health?

- Worker to be free of physical, physiological and mental illness during work.

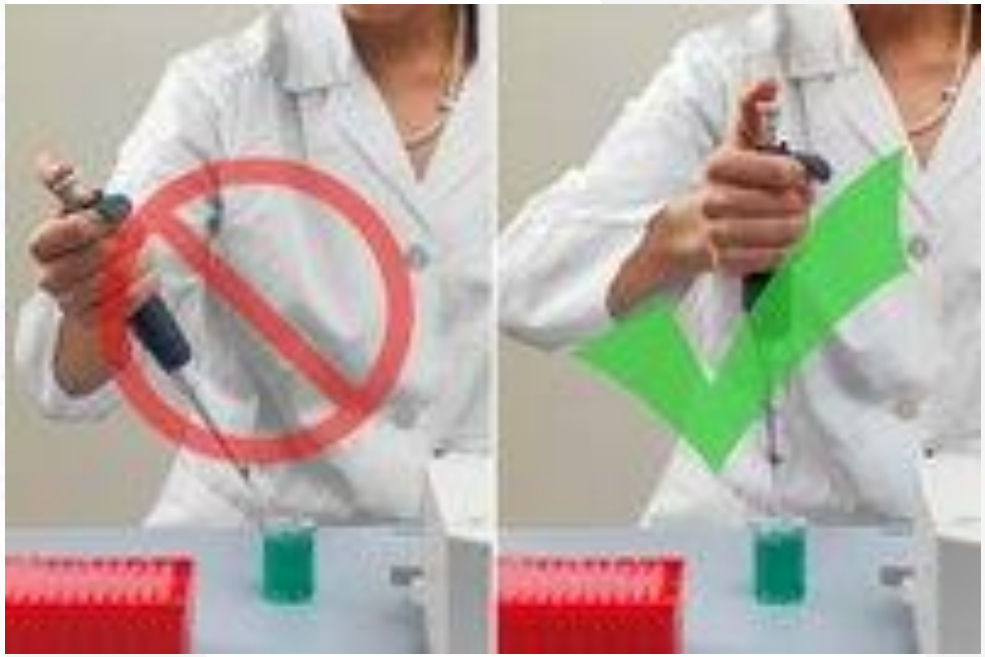
Halim et al., Proceeding of Third National Technical Postgraduate Symposium .2004; pp. 85-89.

Ergonomic risk factors

- High Task Repetition and/ or prolonged activities.
- Forceful Exertions
- Repetitive/Sustained Awkward Postures.
- Static posture
- Vibration
- High/ low temperature for an extended time.

Bhattacharyya &Chakrabarti. Work 43 (2012) 403–409

Ergonomic risk factors



- Ergonomic risk factors can cause a variety of occupational health problems, including fatigue, discomfort, disability and work related musculoskeletal disorders (WRMSDs).

- WRMSDs is referred to conditions where the worker experiences discomforts of neck, shoulder, low back, and elbow, hand, hip and knee, as well as multiple joints manifesting ache, tingle, swelling and pains.

Genaidy et al., Ergonomics, 1995, Vol.38, pp. 1851-1858

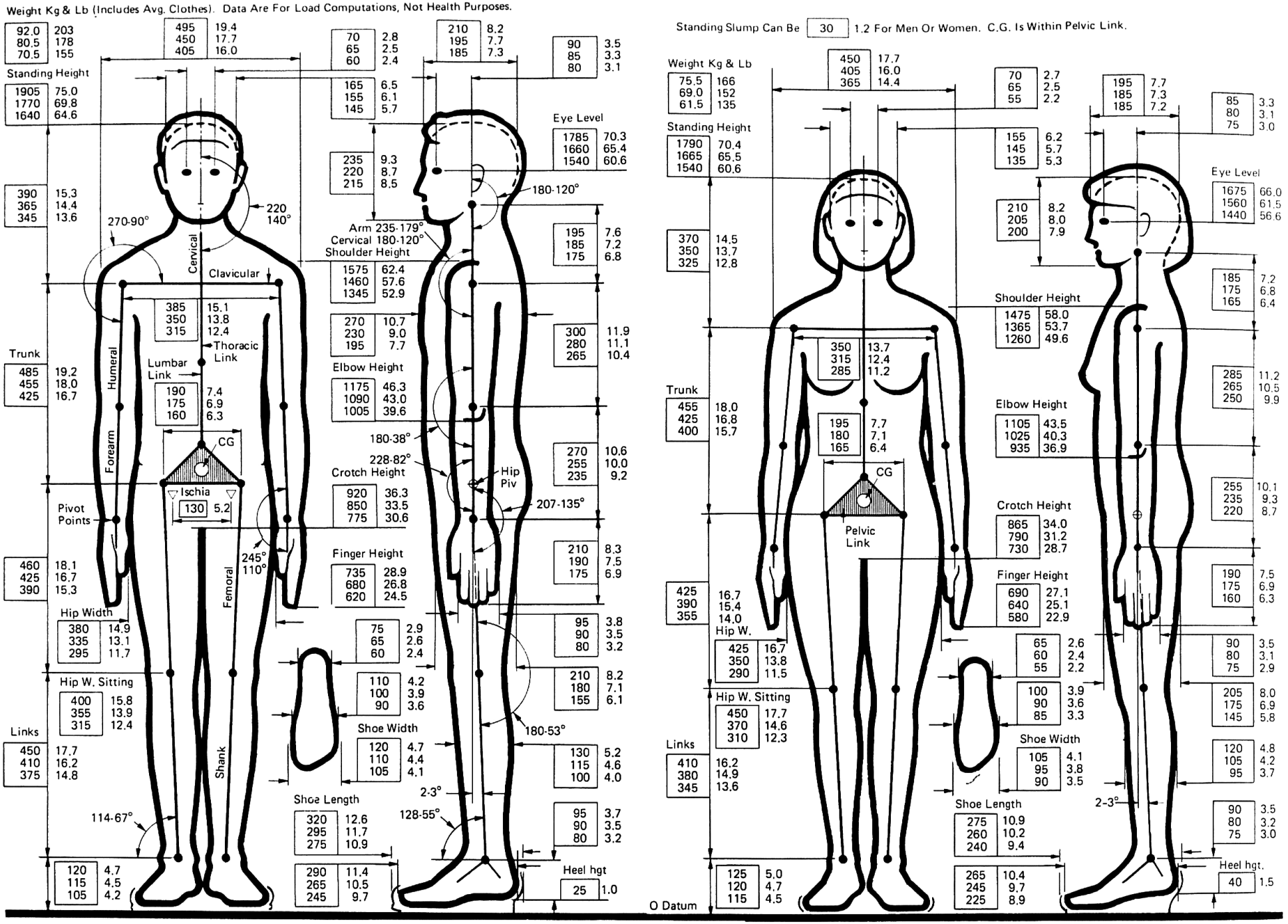
Why does it matter for females health?

- A male to female ratio of 1:3 was described for carpal tunnel syndrome (CTS) in a population study in which occupation was not evaluated (Bruce & Bernard 1997).

- Weight, height, body mass index (BMI), and obesity have all been identified in studies as potential risk factors for certain MSDs, especially CTS and lumbar disc herniation (Bruce & Bernard 1997).

- Female workers have higher injury rates than men for all types of injuries (neck injuries, upper extremity injuries, back injuries lower extremity injuries). that differences between male and female workers are in training, physical capacity, and task assignments .

Kelsh & Sahl, Am J Epidemiol 1996; 143:1050-8.



Male and female standing heights (including shoes):

1905	75.0	1790	70.4 large = 97.5 percentile
1775	69.8	1665	65.5 average = 50 percentile
1640	64.6	1540	60.6 small = 2.5 percentile

} includes 95% U.S. adults.

Niels Diffrient, Alvin R. Tilley; Henry Dreyfuss Associates; New York, New York

Dimensional notation system:

1000	39.3	Numbers appearing in boxes are measurements in millimeters. Numbers outside boxes are measurements in inches.
100	3.9	
25.4	1.0	

Title goes here

- **Frequency of Reported Musculoskeletal Symptoms in Different Body Regions Among the Studied Female Workers During the Last 12 Months Prior to the Study (n = 2934) a**

Body region	Number of Subjects With Symptoms
Neck	1222 (42.3)
Shoulders	1498 (51.5)
Elbows	767 (26.5)
Wrists/Hands	1344 (46.2)
Upper back	1261 (43.7)
Lower back	1493 (51.8)
Thighs	627 (21.9)
Knees	1236 (42.7)
Feet and ankles	1033 (35.7)

- **Factors affecting MSDs symptoms are age, type of activity, working hours and schedule, and job tenure.**

Choobineh A et al., Women's Health Bull. 2015;2(4):e27334

work-related upper extremity musculoskeletal disorders among computer workers

Aim of the study

- Evaluate how much the fundamental ergonomic considerations are implemented and its relation to MSD during computer use among administrative staff worker in Ahlia University, Kingdom of Bahrain.

- To highlights the importance of ergonomics in decreasing and preventing MSD for better production and performance in work.

Material & Methods

Subjects:

50 females administrative staff participated in this study who had used a computer for minimum of 6 months and working minimum for 3 hours per day or 21 hours per week.

Outcomes:

1- Physical characteristic of the subject.

2- Criteria of work place.

3- Painful sites and pain intensity in each site.

4- Ergonomic consideration of human machine unit (monitor distance, seat height, arm angle and knee angle).

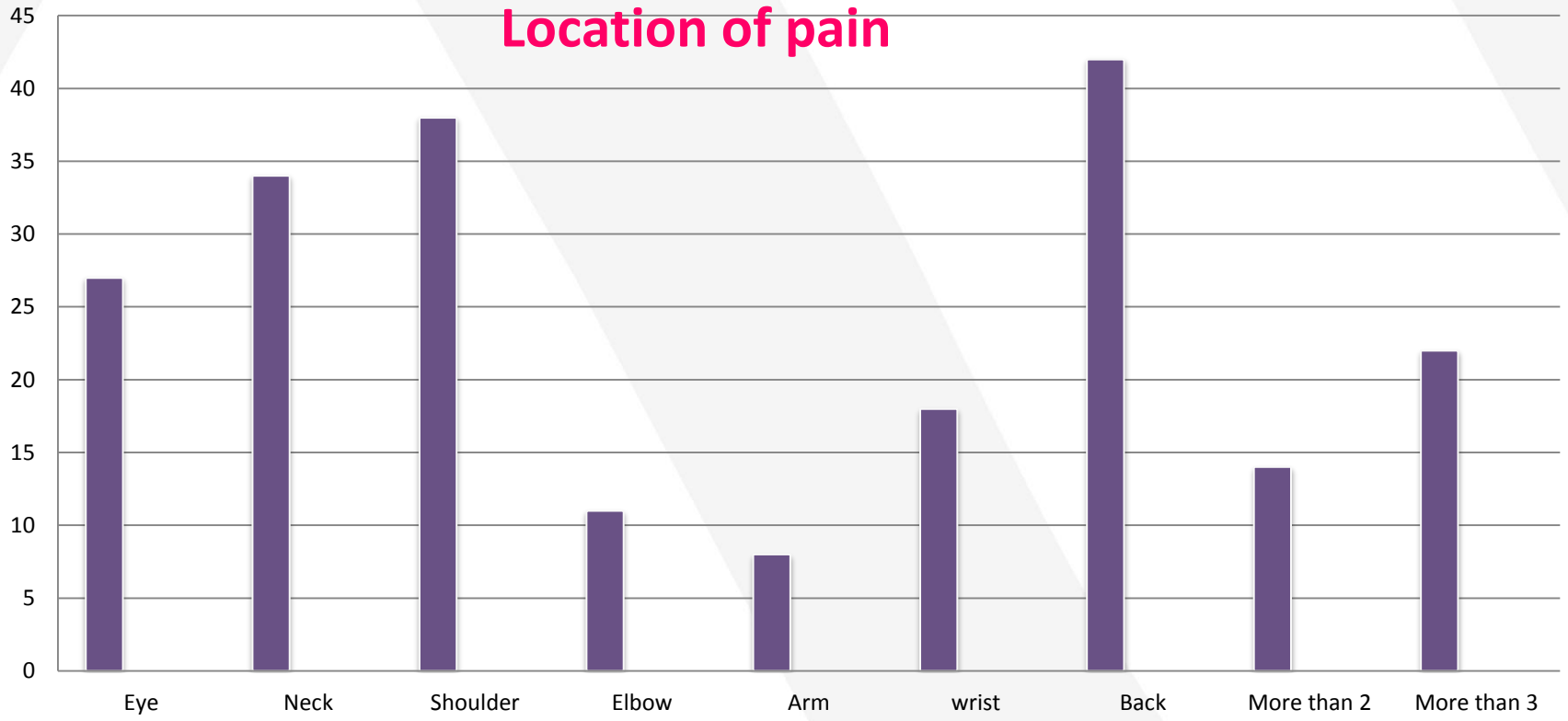
Results

Physical characteristics of the participants:

N=50	Range	Mean	±SD
Age	25 - 55	33.4	± 5.537
Height	150 – 178 cm	166	± 6.776
Weight	52 – 125 kg	74.4	± 19.91

N=50	Range	F	%
Length of computer use in years	6 months – 5 yrs 6 – 10 yrs	36 14	72 28
Length of computer use in Hours per day	3 -6 Above 7	25 25	50 50

Figure 1 : Frequency and percentage of location of pain.



- The result revealed that 84%of the participants' reported pain in the back as well as it was the highest area in pain intensity. poor awkward postures cause fatigue and eventually lead to pain in all body parts (rosemoff, 1993).

- Unfortunately, 35% of subject reported pain in more than 3 areas in the body.

Table 3: The Timing of the Pain.

Timing of the Pain	F	%
Before +During + After work	10	20
During + After work	38	76
After work	2	4

Table 4: Frequency and Percentage of five chairs casters, Foot Rest and mouse pad.

N=50	Range	F	%
Five casters	Yes No	50 -	100 -
Foot Rest	YES No	3 47	6 94
Mouse pad	Yes No	25 25	50 50

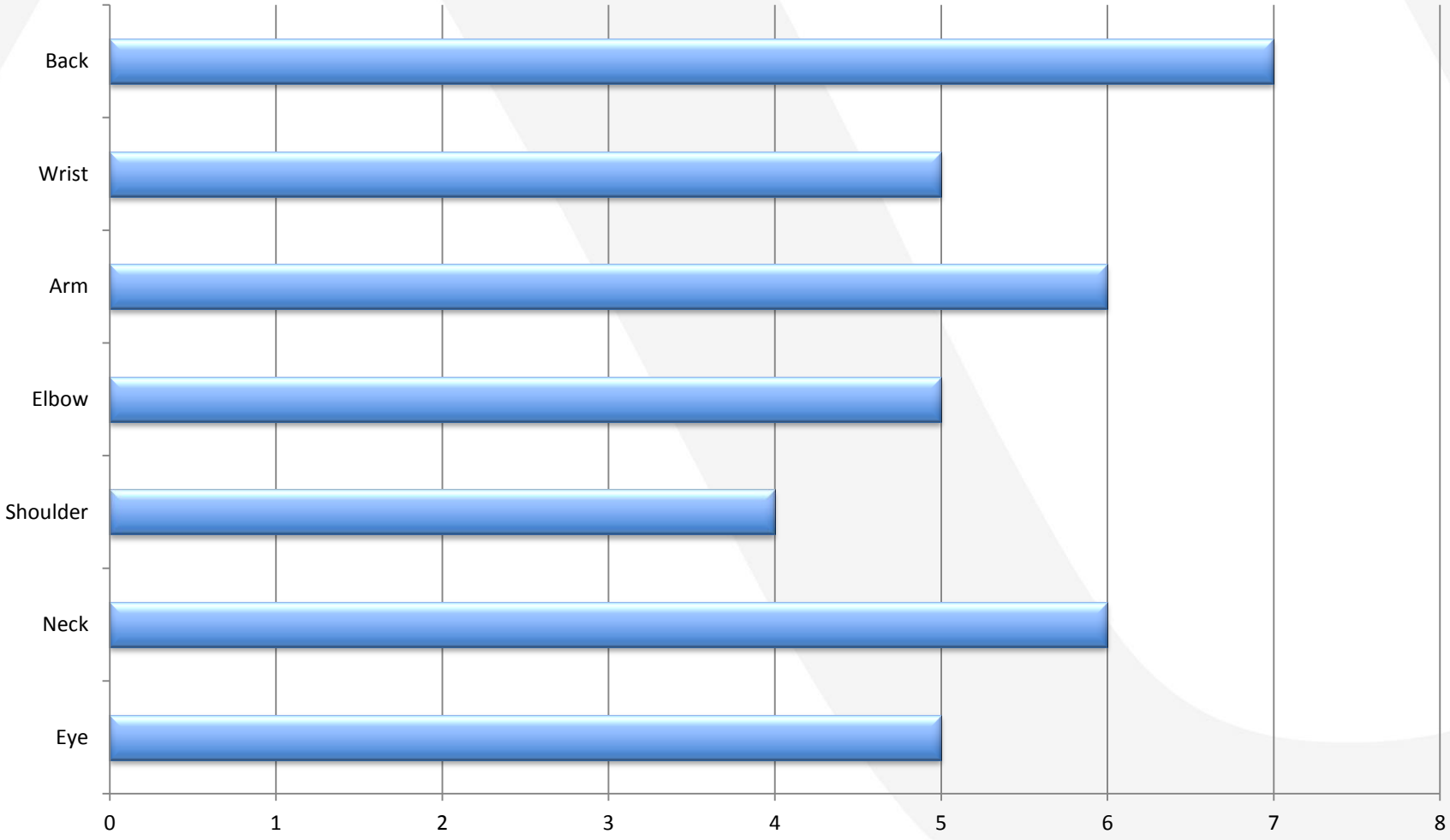
- 76% of subjects reported the pain starts during work and lasts till after work. this result can be explained by the fact that only 6% of our participants had foot rest that relax the back muscle.

- Foot rest is useful to address lower back fatigue when sitting for long periods. Pushing the feet into the footrest helps to push the back into the angled backrest of the chair**(copple,2007)**. Furthermore, people staying in the same position for a long time may result in irregularities in many body parts including muscular contracture, back and leg pain (**Stuart ,1 995**)

N=50	Range	F	%
Using computer after working day	Yes No	44 6	88 12
Have idea about ergonomic	YES No	35 15	70 30

The ergonomic knowledge is 70% among our participants which is considered high. Despite this there was high percentage of musculoskeletal pain, which due to lack of application of ergonomic principles by the staff and also the long hours that our participants are working on their computers **(Sawyer, 2004).**

Rate of Pain on VAS



- 76% participant reported pain in the shoulder with pain intensity (score 4), prolonged use of a mouse and keyboard may give rise to pain in all upper extremity joints and mostly carpal tunnel syndrome (**Russell ,2001**).

- while 68% had pain in the neck with (score 6) of pain intensity , this can be explained as computer screen was also at the corner to all participants which is in contrast to the guideline of ergonomic.(**NIOSH, 2008).**

- 54 % had pain in the eyes with (score 4) this can explained by the fact that concentrating on the screen for a long period of time may lead to dry eyes that could be sore, due to screen size ,font size, and poor image quality (**Hogan, 2000**)

Qualitative data analysis

N=50	Average	Minimal Rang	Maximal Rang	Ideal Average
Monitor Distance	68.4 cm	(10) 20%	(21) 42%	(19) 38%
Chair Height	47 cm	(1) 2%	(7) 14%	(42) 84%

Qualitative data analysis

N=50	Average	<90°	> 90°	Ideal Average 90°
Elbow Flexion	65°	(34) 68%	(3) 6%	(13) 26%
Knee Flexion	93°	(10) 20%	(8) 16%	(32) 64%

Conclusion

- Faulty computer use is one of the most common causes of back pain and other MSD.
- Using computer in the proper way would save money and keep people healthier.
- Concentrating on teaching ergonomics might be the optimal way of reducing MSD.
- We recommend that ergonomics principles should be taught and strictly implemented.

Prevalence of distal upper extremities musculoskeletal disorders due to extensive use of smart phones

- Touch screen is the simplest of all input devices. This simple interface is also be ideal for people who are not regular computer users including disable patient and elderly (Holizinger, 2013).

- Touch screen device handlers are at high danger of gaining repetitive strain injuries (RSI). The repetitive text messaging affects the soft tissues due to repetitive motions.
- Upper extremity musculoskeletal problems especially the thumb have been lately stated for touch screen device users due to text messaging (Eapen, 2014).

Aim of the study

- To investigate the impact of hand held tools (smart phones) on the upper extremity in terms of pain, dysfunction and grip strength.

Material & Methods

- A 100 students (Male n = 34, Female n = 66) recruited from Ahlia University, Bahrain.

Inclusion criteria	Exclusion criteria
• Age: 17-30 years. • Sending at least 5 emails or text messages / day. • Playing games or Surfing the internet for more than 1 hour /day using the hand held devices.	• Subjects with current injury (less than six months) to the hand or upper extremity. • any degenerative, inflammatory, musculoskeletal or neuromuscular conditions of the upper extremity or hand affecting the use of the extremity in the activities of daily living.

(Sharan et al., 2014, Eapen et al., 2014).

Outcomes

- self-developed questionnaire collecting the demographic data.
- Cornell Mobile Phone Hand Discomfort Questionnaires (CMPHDQ).
- Special tests :

1) phalen tests , 2) Cozen's test, 3) Froment's sign test, 4) finkelstein test

- Hand Grip strength test .

Results

1- It was found 71% of participants use mobile phone more than 20 texts per day.

2- The majority use their right (R) hand to touch screen (60%) and(48%) to hold the mobile phone.

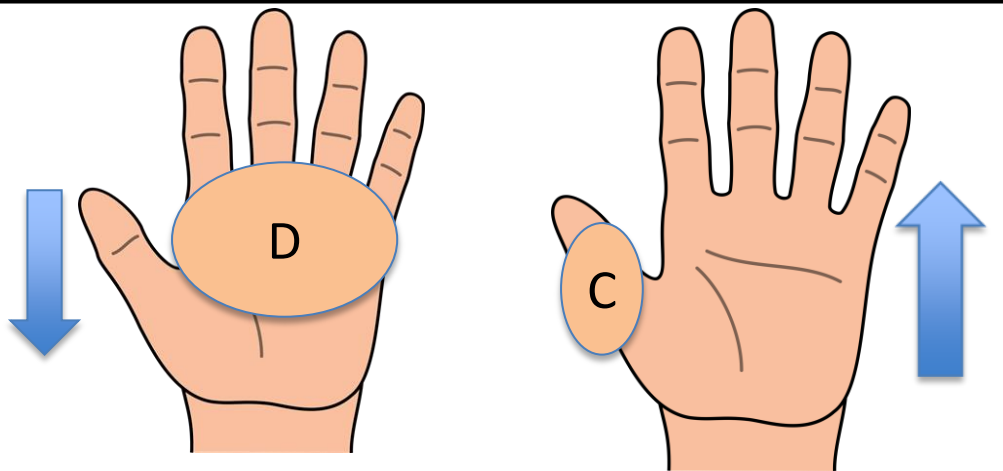
3- (49%) were experiencing pain or numbness during touch screen devices use. Despite of this, 51% of them, their pain did not interfere with their activity.

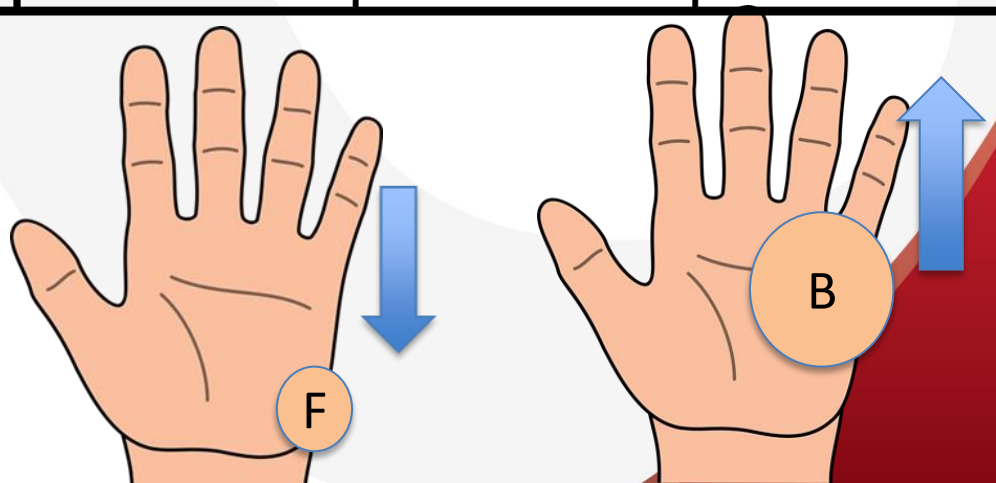
A	B	C	D	Total
q1) How many times you use mobile? (for e.g. texting, calling, browsing ..ect.)				
10	16	71	3	100
10.00%	16.00%	71.00%	3.00%	100%
q2) Which hand are you use to hold the mobile?				
48	6	46	0	100
48.00%	6.00%	46.00%	0.00%	100%
q3) Which hand are you use to touch screen?				
60	5	35	0	100
60.00%	5.00%	35.00%	0.00%	100%
q4)For how long you have been using touch screen devices?				
9	39	47	5	100
9.00%	39.00%	47.00%	5.00%	100%
q5) What is your upper limb position during using moblie?				
29	71	0	0	100
29.00%	71.00%	0.00%	0.00%	100%
q6) Do you have any pain or numbness?				
49	51	0	0	100
49.00%	51.00%	0.00%	0.00%	100.00%
q7) When do you experience pain or numbness?				
30	19	0	0	49
30.00%	19.00%	0.00%	0.00%	49.00%
q8) Does the pain and numbness stop you from doing the activity ?				
24	25	0	0	49
24.00%	25.00%	0.00%	0.00%	49.00%

Cornell Mobile Phone Hand Discomfort Questionnaire (CMPHDQ) :

i – Total scoring of pain and discomfort on CMPHDQ:

Area	All R Hand	All L Hand	Female R Hand	Female L Hand	Male R Hand	Male L Hand
A	126.5	24.5	116	21.5	8.5	3
B	73	39.5	55	26	18	13.5
C	304.5	37.5	294	34.5	10.5	3
D	34	34.5	37.5	21	16.5	13.5
E	256.5	38	213	36.5	43.5	1.5
F	73	21.5	64.5	20	8.5	1.5





ii – Degree of discomfort R hand (Males)

	Slightly discomfortable	Moderatly discomfortable	Very discomfortable
Area (A)	1	1	0
Area (B)	2	0	1
Area (C)	4	1	0
Area (D)	2	0	1
Area (E)	2	2	1
Area (F)	1	1	0

ii – Degree of discomfort R hand (females)

	Slightly discomfortable	Moderatly discomfortable	Very discomfortable
Area (A)	9	4	1
Area (B)	5	5	0
Area (C)	9	9	2
Area (D)	2	1	1
Area (E)	12	8	1
Area (F)	4	11	0

Special tests results of male subjects:

Test		Positive (Only R)	Positive (Only L)	Negative (Only R)	Negative (Only L)	total hands
Phalen	count	2	0	32	34	68
	%	2.94%	0.00%	47.06%	50.00%	100.00%
Finklester	count	18	13	16	21	68
	%	26.47%	19.12%	23.53%	30.88%	100.00%
Cozen's	count	6	6	28	28	68
	%	8.82%	8.82%	41.18%	41.18%	100.00%
Froment's	count	0	0	34	34	68
	%	0.00%	0.00%	50.00%	50.00%	100.00%

Special tests results of female subjects:

Test		Positive (Only R)	Positive (Only L)	Negative (Only R)	Negative (Only L)	total hands
Phalen	count	10	4	56	62	132
	%	14.71%	5.88%	82.35%	91.18%	194.12%
Finklester	count	26	15	40	51	132
	%	38.24%	22.06%	58.82%	75.00%	194.12%
Cozen's	count	9	5	57	61	132
	%	13.24%	7.35%	83.82%	89.71%	194.12%
Froment's	count	1	1	65	65	132
	%	1.47%	1.47%	95.59%	95.59%	194.12%

Subjects who showed positive results in more than one test :

	special tests				Right	Left
1	phalen	Finklesten	Cozen's		3	0
2	phalen	Finklesten			3	0
3	phalen			froment's	1	0
4		Finklesten	Cozen's		6	4
5		Finklesten		froment's	0	1

Special test in all subjects with positive results in both hands

	Phalen			Finklesten			Cozen			forment		
	right	left	Both	right	left	Both	right	left	Both	right	left	Both
Total	11	4	4	43	28	14	14	11	3	1	1	0
Male	3	0	0	19	12	8	6	6	2	0	0	0
Female	8	4	4	24	16	6	8	5	1	1	1	0

Mean of hand grip strength:

	Total		Male		Female	
	Right	Left	Right	Left	Right	Left
STDEV	13.01	12.57	10.64	10.12	5.43	5.23
average	25.27	23.16	39.96	37.43	17.71	15.80
max	72.00	65.00	72.00	65.00	35.00	35.00
min	4.00	4.00	16.00	10.00	4.00	4.00

Explanation of results

1- +ve Finklestin test and high pain score of area C (thumb area) were due to:

texting more than 20 times/day, led to myofascial pain syndrome and tendinosis of extensor pollicis longus muscle, extensor digitorum communis, thenar muscles and the first interossei muscles (Sharan et al., 2012).

- 2- Right hand Highest scores, were due to:

 * 91% of subjects were R handed.

 * (48%) reported holding the mobile with R hand.

 * (60%) reported touch screen with R hand.

 * 71% flexed their R elbow while using the mobile which put this area in stressful positioning.

Area C (thumb area) showed the highest score of pain and discomfort in female subjects than males are due to:

- During texting, females had greater muscular activity in the abductor pollicis longus muscle and extensor digitorum muscle compared to males.
- Females tended to have more thumb abduction and more thumb movement speeds with less stops in the thumb movement (Gustafsson et al., 2010 & Eapen, 2010).

Ergonomics correction strategies

- Engineering Controls

– Eliminating excessive force and awkward posture requirements .

– Using mechanical assists, adjustable height lift tables and workstations, powered equipment and ergonomic tools .

– Eliminate or reduce awkward postures . Accomplish work tasks within the mid-range of motion positions.

NIOHS, 2013

- Work Practice Controls

– Providing safe & effective procedures for completing work tasks.

– Using carts and dollies to reduce lifting and carrying demands, sliding objects instead of carrying or lifting.

– workers should be trained on proper work technique

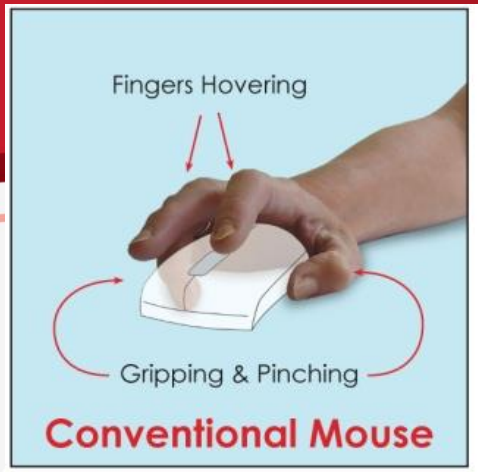
- Job Rotation –

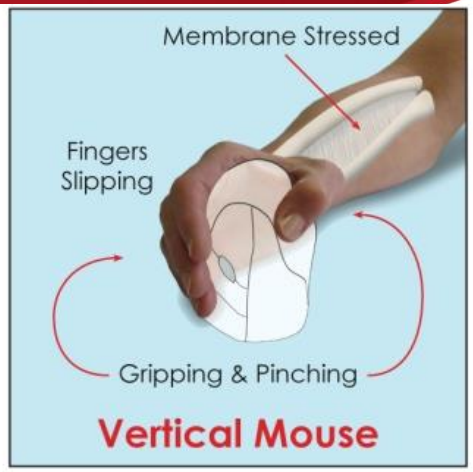
  Workers can rotate between workstations and tasks to avoid prolonged periods of performing a single task, thereby reducing fatigue that can lead to MSD.

- Counteractive Stretch Breaks – Implement rest or stretch breaks to provide an opportunity for increased circulation needed for recovery

- Proper Body Mechanics – Workers should be trained to use proper lifting and work techniques to reduce force requirements.


Move the
mouse with
your arm not
your wrist





Evolution of the Mouse


45°
22°
POSTURE


WRIST POSITION


Makita
Makita
Old Makita
Cordless Drill
Ergonomics on Cordless Drills
Change of
Angle on the Handle
(c) www.insidewoodworking.com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Maximizes Power - Minimizes Hand & Wrist Stress
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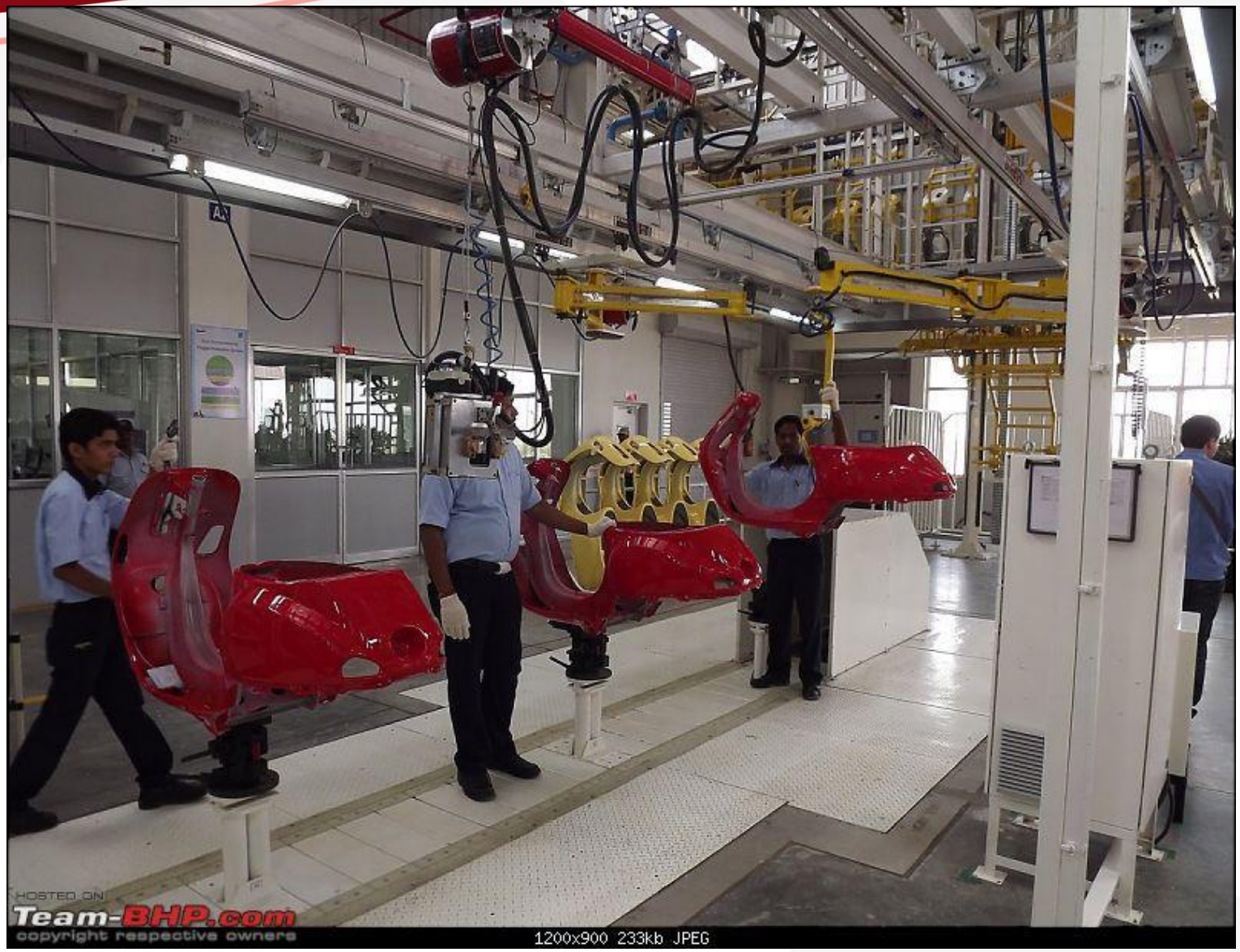
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Why It Matters?
Good Ergonomics = Good Economics

Lowers	Improving
injury rates and MSD incidences	Improved worker safety & comfort
Reduction in human costs associated with MSDs. Reduction in company direct and indirect costs associated with MSDs	Increased productivity from making jobs easier and more comfortable for workers
Reduced worker fatigue.	Improved product quality. Studies have shown a corresponding relationship between good ergonomics and improved product quality
Reduced absences because workers will be less likely to take time off to recover from muscle soreness, fatigue, and MSD-related problems.	
Reduced turnover as workers are more likely to find an ergonomically designed job more satisfying and within their physical capacity.	