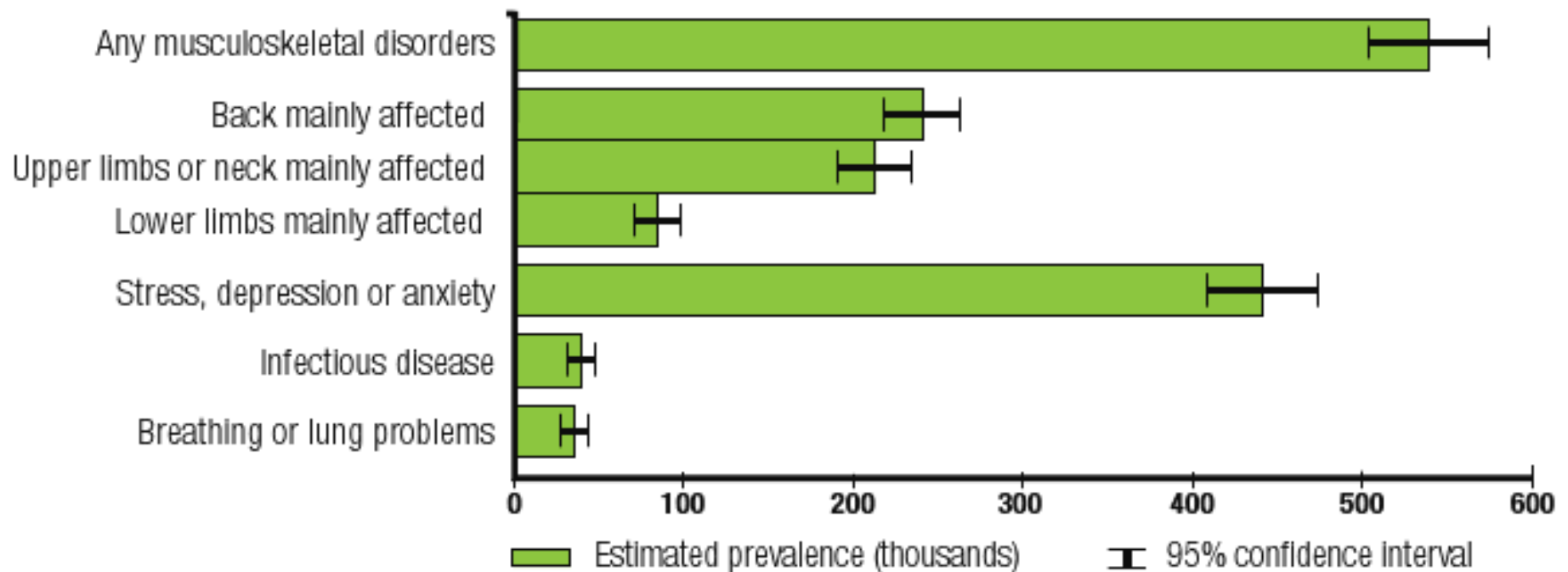


# MANUAL MATERIAL HANDLING

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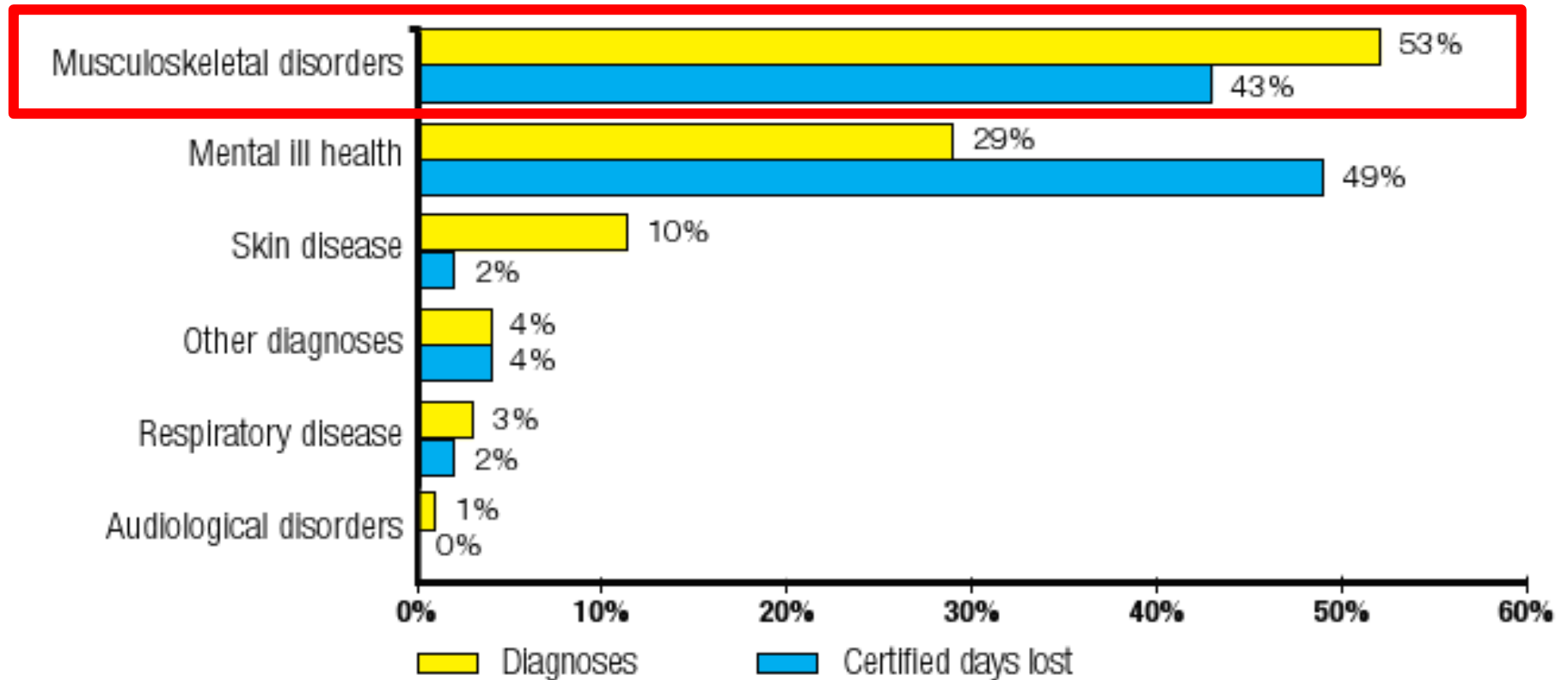
# Case : British workers

**Figure 1:** Estimated prevalence of self-reported work-related illness, by type of complaint, for people working in the last 12 months, 2007/08



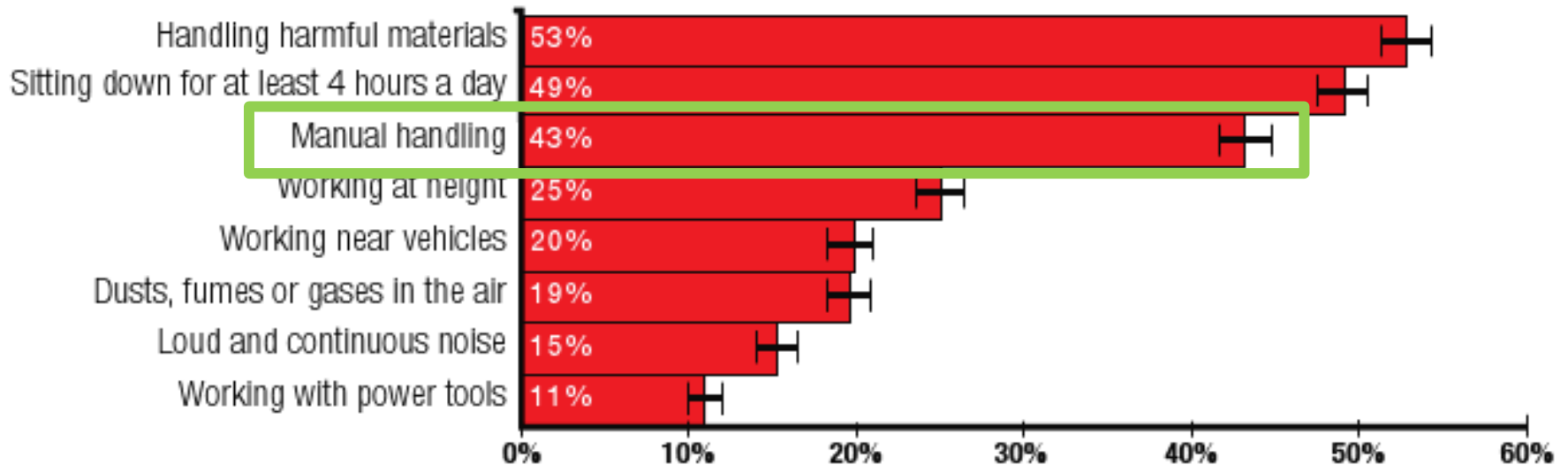
# Case : British workers

Figure 2: Proportion of cases and certified days lost by diagnosis as reported by General Practitioners for 2006–2007



# Case : British workers

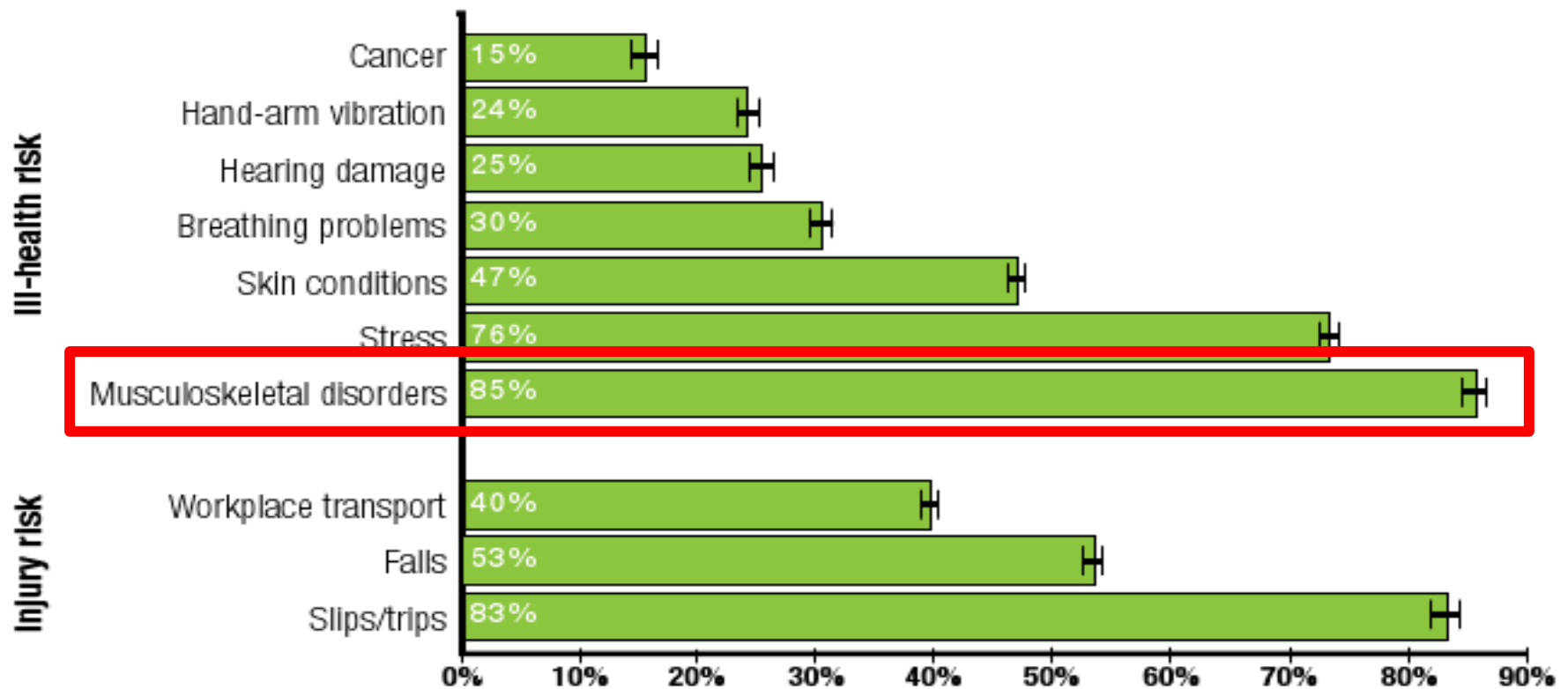
**Figure 10: Percentage of British workers that report selected working condition in 2008\***



\* Source: Fit3 worker survey 2008.

# Case : British workers

Figure 11: Percentage of employers stating their workers could be exposed to various work-related ill-health or injury risks\*



\* Source: Fit3 employer survey 2007.

**Note:** Data on this page are not National Statistics. See 'Sources and definitions' for Fit3 employer survey.

# Manual Material Handling



# MMH System



## Individual (Worker)

- Physical
- Sensory
- Personality
- Experience
- Health
- Activity



## Material

- Load
- Dimension
- Distribution of load
- Handles
- Stability of load



## Workplace

- Workplace geometry
- Environment
- Frequency



## Company (Industry)

- Teamwork
- Safety policy
- HSE people
- Shifting
- Insurance support
- Personal protective devices

# How to measure ??

**Biomechanical approach** → remember ??

**Physiological (or cardiovascular) approach** → HR, O<sub>2</sub> consumption, energy consumption.

**Psychological approach** → stress level, load index

**Mixed approach** → combine several methods



# MH task types



**Pulling/pushing**



**Holding**



**Carrying**



**Lifting**

# **NIOSH Lifting Equation**

# Lifting

- NIOSH (1994) menetapkan formulasi untuk menentukan **Recommended Weight Limit (RWL) & Lifting Index (LI)** untuk aktivitas pengangkatan beban tertentu.
- RWL merupakan **rekomendasi batas beban** yang dapat diangkat oleh manusia **tanpa menimbulkan cedera** meskipun pekerjaan tersebut dilakukan secara **repetitive** dan dalam **jangka waktu tertentu**.
- LI digunakan untuk mengetahui **index pengangkatan** apakah proses pengangkatan menimbulkan **resiko cedera tulang belakang atau tidak**.

# Advantages of NIOSH Lifting Equation

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- Help identify potentially hazardous lifting jobs.
- Help in design/modification process.
- Help prioritize evaluation of lifting tasks

# Kapan persamaan NIOSH berlaku ?

1. Beban yang diberikan adalah beban statis, tidak ada penambahan/pengurangan beban ditengah-tengah pekerjaan.
2. Beban diangkat dengan kedua tangan.
3. Pengangkatan atau penurunan benda dilakukan dalam waktu maksimal 8 jam.
4. Pengangkatan atau penurunan benda tidak boleh dilakukan saat duduk atau berlutut.
5. Tempat kerja tidak sempit.

# RWL

$$\mathbf{RWL = LC \times HM \times VM \times DM \times AM \times FM \times CM}$$

Keterangan :

- LC : (Lifting Constanta) konstanta pembebanan
- HM : (Horizontal Multiplier) faktor pengali horisontal
- VM : (Vertical Multiplier) faktor pengali vertikal
- DM : (Distance Multiplier) faktor pengali perpindahan
- AM : (Asymmetric Multiplier) faktor pengali asimetrik
- FM : (Frequency Multiplier) faktor pengali frekuensi
- CM : (*Coupling Multiplier*) faktor pengali kopling (handle)

# 1. LC (Load constant)

---

**LC → 23 kg (230N) or 51 lbs**

(acceptable to 75% of female population)

## 2. HM (Horizontal Multiplier)

H → horizontal distance of hands from midpoint between ankles.

$$\text{HM (metric)} = 25 / H$$

$$\text{HM (english)} = 10 / H$$





### 3. VM (Vertical Multiplier)

$V \rightarrow$  vertical distance of hands from floor

$$VM = (1 - 0.003 | V - 75 |)$$

$V$  in cm

$$VM = (1 - 0.0075 | V - 30 |)$$

$V$  in inches



## 4. DM (Distance Multiplier)

D → the total vertical distance moved between origin and destination

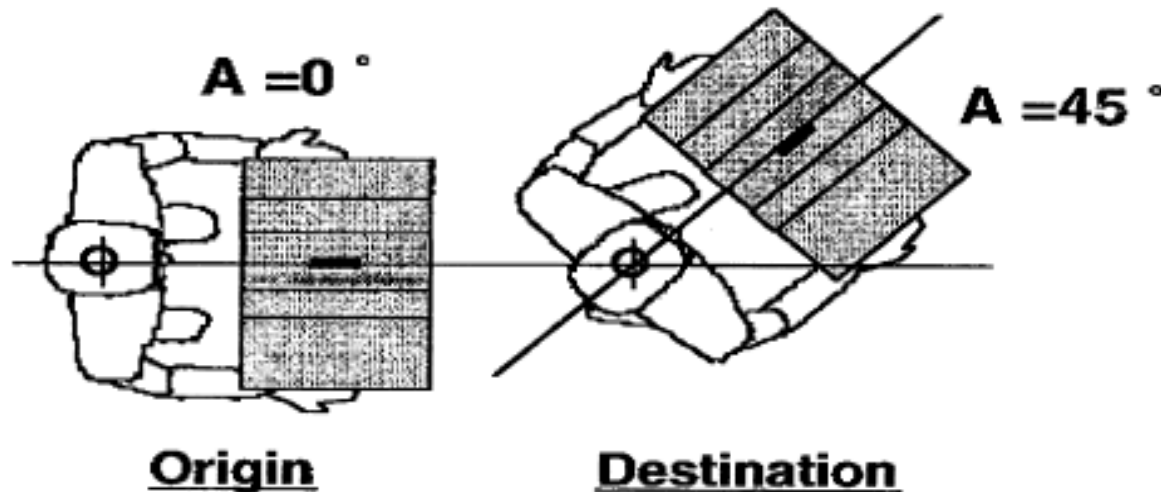
$$DM = (0.82 + (4.5 / D)) \quad \text{in cm}$$

$$DM = (0.82 + (1.8 / D)) \quad \text{in inches}$$

# 5. AM (Asymmetric Multiplier)

A → angle of asymmetry (angular displacement)

$$AM = ( 1 - (0.0032 A))$$



## 6. FM (Frequency Multiplier)

---

Based on work duration ( $\leq 1$  hr,  $\leq 2$ hr,  $\leq 8$ hr)  
and  $V$  (vertical distance of hands from floor, in cm)  
and Frequency (rate of lifting) lifts/min.

**See FM Table**

# 7. CM (Coupling Multiplier)

---

Based on  $V$  (vertical distance of hands from floor, in cm)  
and quality of coupling

**See CM Table**

# LI

- **LI = Berat beban/RWL**
- Jika  $LI > 1 \rightarrow$  mengandung resiko cedera tulang belakang.
- Jika  $LI \leq 1 \rightarrow$  tidak mengandung resiko cedera tulang belakang

# Designing to avoid back pain

- *More importantly*, NIOSH equation gives ways to reduce injury
  - reduce horizontal distance
  - keep load at waist height
  - reduce distance to be travelled
  - reduce twisting
  - add handles
  - reduce frequency of lifts



**THANK YOU ...**