

Work RATES & PACING:

Hazard Identification & Control

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OVERVIEW

- **ISSUES?**
 - RATES
 - PACING
- RISKS – Fatigue, Stress, MSDs, error-related Injuries
- **HAZARDS:**
 - physical
 - perceptual / cognitive - RATES
 - psychosocial – PACING
- RESEARCH EVIDENCE from Melbourne manufacturing companies
- **WHAT YOU CAN YOU DO? Identifying & controlling hazards**

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WORK RATES – average speed of work

DETERMINED BY:

- Need to meet targets, standards
- Keep up with line speeds
- Complete work in given time frame
- Meet deadlines

WORK PACING – control over variability of own work rate

DETERMINED BY:

- work organisation, e.g. moving line? targets?
- machine speeds, production processes, cycle times
- supervision practices and management policy - *able* to stop the line? *acceptable* to stop it?
- how much 'say' people have – ability to participate and be 'heard'

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Common **misconceptions** about causes of MSDs

Names like 'manual handling' injuries and 'body stressing' injuries in Standards, Codes and guidance materials perpetuates beliefs that:

- MSDs are **CAUSED only by physical factors** **UNTRUE**
- MSD risk therefore **CONTROLLABLE only by reducing physical risks.** **UNTRUE**

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- **HAZARDS:**
 - **physical demands**
 - **perceptual / cognitive demands**
 - **psychosocial factors**
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WORK **DEMANDS** ARE IMPORTANT BECAUSE

Coping with Demands takes Effort

Higher Work Demands take more Effort, which is more **Fatiguing**

WORK RATES ARE IMPORTANT BECAUSE

Coping with demands also takes Time

RESPONSE TIME ELEMENTS

- sensory organs (eyes, ears): **1-38 ms**
- travel time to brain: **2-100 ms**
- **mental processing:** **70 - 300 ms**
- travel time brain to muscles: **10-20 ms**
- muscle response time: **30-70 ms**

TASK DEMANDS: Psychological

- effortful, fatiguing, **and first three also TAKE TIME**

- **Sensing / perceiving:** carefully looking, listening, touching, etc to obtain information and understanding
- **Decision making:** choosing, deciding, remembering, problem-solving
- **Psychomotor control:** making movements that are accurate, precise, well-timed
- **Attentional effort and control:** concentrating, sharing attention optimally, ignoring distractions
- **Emotional control:** displaying 'correct' façade (e.g. polite and interested); hiding real feelings (e.g. anger, distress) if necessary

TASK DEMANDS: Physical

effortful, fatiguing, and directly increase injury risk

- forceful exertions
 - whole body: large muscles
 - localised: e.g. pinch grip; local external force
- sustained static muscle loading
- awkward body postures
- highly repetitive movements
- vibration (interacts with muscular exertion)
- trunk twisting velocity

Overall Job DEMANDS

▲ effort required; (can ▲ stress)

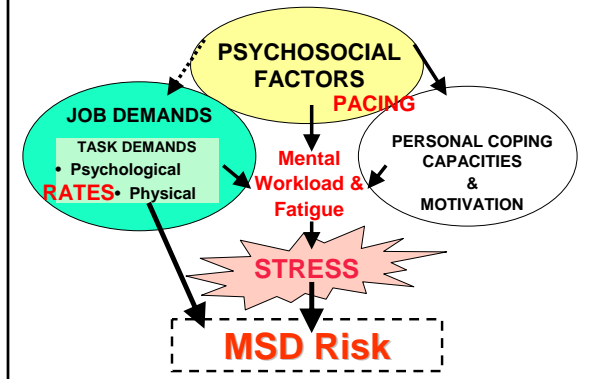
- **Too much to do:** insufficient personal time - work 'intensification'
- **Time pressures:** high work rate, deadlines, dealing with crisis situations
- **Responsibilities:** major consequences of actions, errors
- **High rate of change, Uncertainties:** organisational and technological changes, re-learning, job insecurity

Psychosocial Hazards

can: ▼ coping capacity; ▼ motivation; ▲ stress

- **Demanding shift schedule:** inflexible, unpredictable, unsocial, night work
- **Lack of control over work** / low autonomy / low participation
- **Lack of variety / interest:** short work cycles, fragmented or meaningless work, under-use of skills, monotony
- **Lack of support:** resources, e.g. equipment, personal
- **Poor interpersonal relationships:** isolation, conflict
- **Role conflicts / ambiguities**
- **Home / work conflicts**
- **Job insecurity, career uncertainty**

Causes of Fatigue, Stress, MSDs



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What We Did

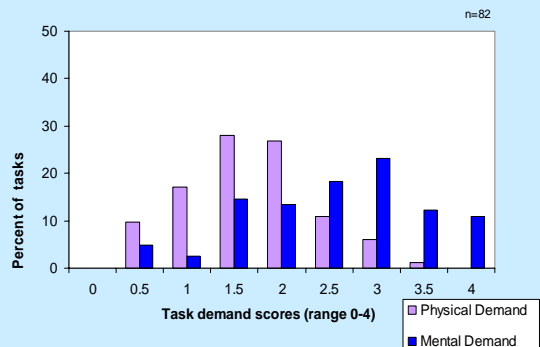
STAGE 1 - 1997 - 1999

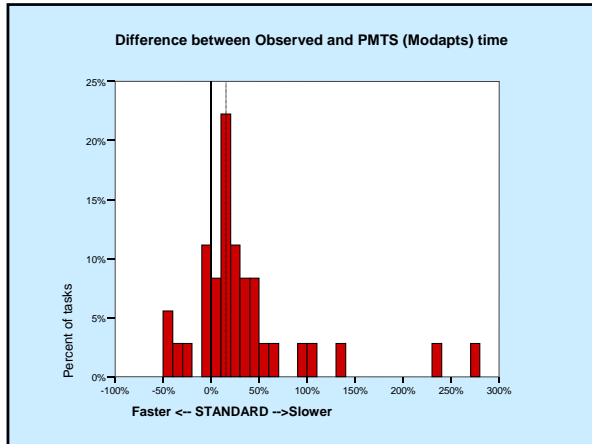
- 20 Melbourne companies - manufacturing
- 82 tasks – repetitive, 'externally' paced
- **Interview Survey:** 37 production managers/ supervisors; 12 OH&S managers/ supervisors; 210 employees (at least 2 per task)

STAGE 2 - 1998 - 1999

- 'In-depth' survey and analyses of subset of 36 tasks

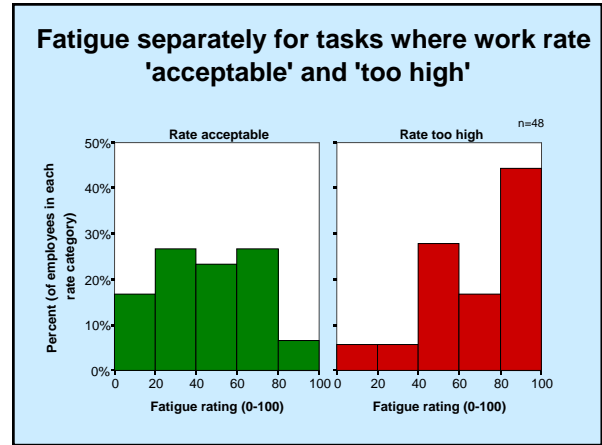
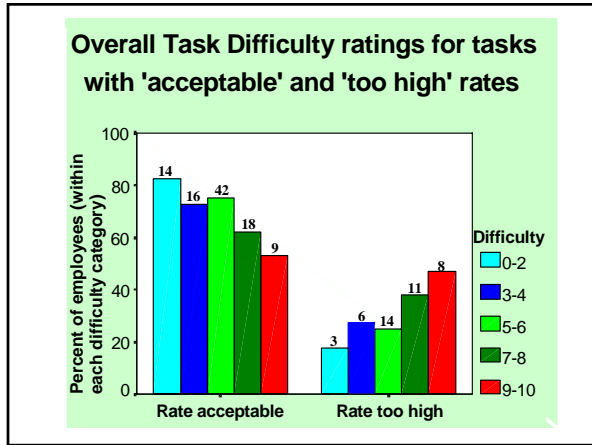
Physical and Mental Task Demand Scores





Employee Ratings of Target or Line Speed

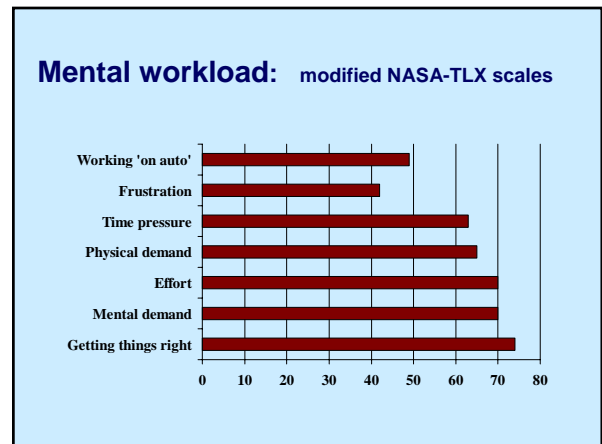
- 65% of employees = 'about right'
- 30% = too high
- 5% = too low.



Fatigue higher with ...

	Beta	Sig.
Workload score	.441	.000
General satisfaction	-.394	.000
Rate set by orders/deadlines	-.217	.033
Work rate too high	.191	.089

F = 19.32, p<.000, Adj. R² = .63



Stress was higher with:

- higher **Workload score** $\beta = .42$
- shorter **cycle time** $\beta = -.28$
- **paced by machine or line speed** $\beta = .21$
- poorer job design (less satisfying) $\beta = -.14$

$F = 7.57, p < .000; \text{Adj.}R^2 = .32$

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HAZARDS: TASK DEMANDS

Failure to allow enough working time for:

- looking or listening at different sources of information – **unclear, or larger amount**
- concentrate to choose between alternatives – **more alternatives**
- precise, accurate movements – **more precision**
- care to get things exactly right, avoid errors – **more care**
- paying attention to other things while working (e.g. dealing with other people – **distractions, extra tasks**)

Failure to allow enough time for more frequent / longer rest breaks if:

- **'heavy' work**: significant force, metabolic load – fatiguing
- **awkward or static postures** – fatiguing
- **emotionally demanding work** – fatiguing

HAZARDS: JOB DESIGN and ENVIRONMENT

Poor design of jobs / environment:

- production targets too high.
- making an error might have significant consequences
- short cycle times
- little control over how work is done
- unclear about quality of work expected
- have to deal with interruptions
- perform same task for long periods without a break
- unable to take a break when needed
- work extended shifts, or long hours per week/month
- work night shifts
- perform this task only occasionally
- feel efforts unappreciated by supervisors or management
- conflict within work group, lack of team work
- uncomfortably hot
- feel exposed to risk of injury

HAZARDS: PLANT, MATERIALS, PROCESS

- plant or machinery unreliable, or needs frequent maintenance
- delays in supply of necessary materials, information or other resources
- quality of materials processed is poor or variable
- materials are poorly organised (e.g. not pre-sorted or otherwise prepared)

HAZARDS: WORKSTATION

- cluttered areas with a lack of space to move around easily
- tools or equipment that are awkward or heavy for some operators
- working heights or furniture that don't fit people's physical size

HAZARDS: INDIVIDUAL EMPLOYEES

- not fully experienced
- not fully trained
- just returned from leave
- have an injury or disability that affects their work
- having difficulties coping with personal problems (e.g. with family)

Causes of Fatigue, Stress, MSDs



More information...

This presentation:

<http://www.latrobe.edu.au/ergonomics>

Macdonald, W. 2004. Workload, stress and psychosocial factors as hazards for musculoskeletal disorders. *Journal of Occupational Health and Safety – Australia and New Zealand*. 20(1), 37-47.

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