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Fatigue and Human Factors



The (basic) Physiology of Fatigue

Associated with lack of sleep & extended wakefulness

Basic mechanisms of sleep / wake systems understood

- **Complex interaction between light, hormones and other zeitgebers**

No known biological correlate of fatigue (i.e. no 'fatigue molecule')



The (basic) Physiology of Fatigue

3 main factors

- **Time awake**
 - Homeostatic sleep pressure
- **Time asleep**
 - also affected by quality, consolidation, medical conditions
- **Time of day**
 - circadian rhythms



Performance & Error

- **Performance declines with time awake**
 - Functional equivalence studies have shown that after 17-19 hours of wakefulness, performance on certain tasks can be the same as a BAC of 0.05%.
 - After 9 hours (time on task) fatigue related risk starts to increase exponentially, such that after 16 hours risk is tripled (Note these studies were undertaken measuring work time, rather than time awake).



Performance & Error

- **Performance recovers with sleep**
 - 6 hours only allows maintenance of performance, typically at a lower level than fully rested
 - “Recovery” typically occurs with a sleep opportunity of greater than 8 hours



Performance & Error

- **Performance fluctuates with circadian troughs**
 - Maximum waking influence during day
 - Minimum waking influence during night
 - Minor dip in early afternoon (2-4 pm)



Fatigue and junior doctors

- **Gander et al . (2007) – NZ**
 - 30% excessive sleepiness
 - 66% felt close to falling asleep at the wheel
 - 42% reported a fatigue related clinical error in past 6 months
- **Flurry of activity and research in UK & USA due to regulatory interventions**
- **Little (published) research in healthcare**



Self awareness of Fatigue

- **Self report is poor**
 - Habituation
 - Fatigue itself affects judgment (cf. alcohol)



Fatigue and the Law

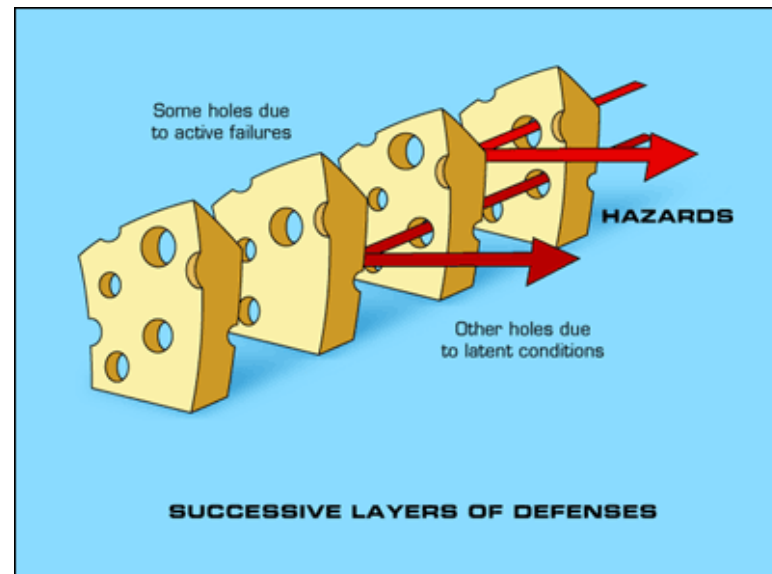
- **OHS law**
- **Industrial Relations agreements**
- **Workers' compensation**
- **Negligence**
- **Criminal law**

- **Not law per se, but AMA Code of Practice**



Managing fatigue

- A single intervention is unlikely to eliminate fatigue risk
 - “Swiss cheese” approach
(J. Reason)





Managing fatigue

- **Examples of layers that could be added:**
 - Scan how activities interact with fatigue factors (ie schedules that require too long wake / too short sleep opportunity)
 - Survey what is happening (how many hours sleep are people getting)
 - Conduct root cause analyses on accidents and near misses
 - Policies in relation to napping (and provision of facilities)
 - Staff training
- **Ideally, fatigue management should be an element of an holistic safety management system**



Managing fatigue

- **An effective fatigue risk management system**
 - Addresses the causes of fatigue (time awake, sleep opportunity and sleep obtained, circadian rhythms)
 - Is systematic (e.g. has reporting in place, adopts an appropriate methodology)
 - Considers external interactions (e.g. incentives in arrangements that may cause fatigue)
 - Takes a shared responsibilities approach
 - Works within a ‘just culture’ framework