Introduction to Fatigue Management science
(that’s operationally relevant)

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The basic elements are nothing new

- Scientific studies about work-related fatigue have existed since 1893 in Britain, 1901 in Germany and 1905 in Belgium.

- The Harvard Fatigue Laboratory opened in 1927, and its Mission required the group "...to work with industry to explain the physiology of fatigue."

- Their areas of interest included work hours, work environments, sleep, nutrition and hydration.

- Clarity existed then that work hours impacted outcomes including productivity, absenteeism & machinery damage.

1. Fatigue is a temporary state of impairment that can negatively impact on attention, risk taking, safety, productivity, quality, morale, compliance, profits, and more.

2. It occurs naturally due to factors like:
   a) Poor sleep quality and/or quantity
   b) Workload that is too low (underload) or too high (overload)
   c) Poor nutrition, lack of hydration, etc.
More basics

3. Fatigue is often a protective mechanism: our brain and body are simply telling us to rest/recover.

4. Depending on the cause(s) we might need a break (e.g. to recover from muscular fatigue or intense concentration), a sleep (e.g. to recover from long periods awake), a task change (where applicable), water, food, or a reset (holiday).
Context for today and the future

• The basic science of sleep, fatigue and related aspects of performance is very helpful to understand...to a point
• Enough **basic** science exists right now to successfully manage fatigue substantially better for 99%+ of organisations
• We can already demonstrate that Fatigue Risk Management (and Safety Management) Systems can help **simultaneously** improve **measurable** risk profiles, safety incidents, compliance rates, operational costs, etc.
Context for today and the future

• For advanced Fatigue Management there is definitely value in better understanding the range of individual differences (both between people and within the same person)

• Such data, analysed with other relevant data, allows us to move rapidly towards valid system performance prediction

• In a ‘big data’ context we can use safety events, overtime & sick leave costs, weather forecasts, fuel costs, hazard reports, insurance claims and much more
What additional science is worth knowing about?

• So, the additional ‘science’ needed for the vast majority of industry and government is data science using existing data.

• For today’s purpose, the introduction to necessary science can therefore be kept largely operationally relevant.

• For example: in laboratory studies, getting extra sleep for a week can improve measurable performance two weeks later!!

  Rupp TL; Wesensten NJ; Bliese PD; Balkin TJ. Banking sleep: realization of benefits during subsequent sleep restriction and recovery. SLEEP 2009;32(3):311–321. Open access version: www.ncbi.nlm.nih.gov/pmc/articles/PMC2647785/
What additional science is worth knowing about?

• Use of devices (e.g. smartphones) at night has been shown to negatively impact sleep and work performance the next day

  e.g. Klodiana L; Johnson RE; Barnes CM. Beginning the workday yet already depleted? Consequences of late-night smartphone use and sleep. Organizational Behavior and Human Decision Processes; 2014;124(1):11-23. Open access version: http://www.academia.edu/download/43623096/Beginning_the_workday_yet_already_deplet20160311-29548-16r8b3a.pdf

• Aspects of the issue include blue light, electro-magnetic radiation (e.g. from devices and WiFi) and cognitive hyper-stimulation
What additional science is worth knowing about?

- Other high quality (i.e. well-controlled) operational research studies continue to confirm the basic elements of fatigue.
  
  - E.g. Sallinen, et. al. (2017) followed three groups of pilots recording objective sleep, self-reported (subjective) alertness and other measures recorded in all phases of short- and long-haul flights for 2 months.
  
  - The key risk factor showed was night work.

What additional science is worth knowing about?

• On-call work can negatively impact sleep quality & quantity even before any call/alarm

• This effect is not always apparent in artificial settings (e.g. a research laboratory)

• But can be when additional factors such as perceived stress are considered
What additional science is worth knowing about?

• So, we should focus on real-world research, but much of it is not conclusive.

• For example, we do know that being on-call at a workplace or at home is bad for sleep.

• However, we do not know if that impacts on measurable safety and other performance outcomes of importance.

• Data science will likely overtake basic science; we can tap into relevant variables like commutes (e.g. home v work postcodes), self-assessments of fitness for work (e.g. via apps), historical trends (e.g. events x TOD, week, year), etc.
What if I want to read more of the science?

• There are now numerous portals for searching the scientific and medical literature

• Increasingly, these include links to open source and otherwise free content
  • http://www.ncbi.nlm.nih.gov/pubmed
Questions & Discussion
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