California Training Institute

Science based solutions to human factor issues

Fatigue Related Decrements Are Similar To Alcohol Impairment

Key Review Points

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1. Hours awake and sleep loss are major contributors to fatigue.
2. The National Sleep Foundation [1] studies suggest that healthy adults have a base line (basal) sleep need of seven to eight hours every night.
3. Sleep debt is defined as the hours less sleep you get per night from your basal sleep.
4. Sleep debt is cumulative and there is a complex interaction between the basal need and sleep debt. You might meet your basal sleep need on any single night or a few nights in a row, but still have an unresolved sleep debt that may make you feel more sleepy and less alert at times, particularly in conjunction with circadian dips, those times in the 24-hour cycle when we are biologically programmed to be more sleepy and less alert, such as overnight hours and mid-afternoon. It takes multiple sleep sessions to recover sleep debt.
5. There is laboratory evidence that short sleep durations of 4-5 hours have an immediate negative physiological and neurobehavioral consequences.
6. In OL we discussed how our performance can be directly related to our performance from alcohol impairment (BAC).[2]
7. As a general rule we begin to see impairment at the 16 hour point or a 0.05 BAC equivalent.
8. Computing our fatigue level considering hours awake and sleep debt:

   Step 1: Hrs. awake since you last awakening = ___ hours of wakefulness (consider adding the drive home time to be safe)

   Step 2: Hrs. of sleep debt (Subtract hours of sleep from your basal sleep requirement) ___ hours debt

   Step 3: **Total** - Add Steps 1 & 2 = ___ **Total Hours**

Use the chart below to determine you equivalent BAC performance.

Hrs. Awake	Equivalent BAC
10 Hours	0.00
12 Hours	0.01
14 Hours	0.03
16 hours	0.05
18 Hours	0.07
20 Hours	0.09
22 Hours	0.10
24 Hours	0.14

Any total beyond the 24 hours is beyond the scientific research.

Review the next page carefully to see how fatigue impairs different tasks you may be involved in.

[1] http://sleepfoundation.org

[2] Dawson & Reid, Nature 388; 235, 1997.

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Moderate Sleep Deprivation Impairments [3]

Task	Measure	Baseline BAC 0.0	BAC 0.05	BAC 0.10
Reaction Time	Speed (ms.) Accuracy (misses)	489 0.36	Slowed 9% Decrease 225%	Slowed 16% Decrease 680%
Dual Task	Speed (ms.) Hand Eye Coordination	662 50.59	Slowed 10% Decreased 10%	Slowed 20% Decreased 53%
Tracking	Hand Eye Coordination	47.76	Declined 7%	Declined 57%
Vigilance (Signal Detection)	Speed (ms.) Accuracy (targets detected) Accuracy (false alarms)	958 12.64 1.05	Slowed 14% Declined 14% Declined 55%	Slowed 42% Declined 40% Declined 326%
Spatial Memory	Length of recalled series	5.34	Decreased 13%	Decreased 30%
Tiredness	Personal rating	17.84	Increased 77%	Increased 150%

Look carefully at these impairments and consider how your performance and safety are affected.

[3] **Williamson, A.M., Feyer, A. (2000) Moderate sleep deprivation produces impairments in cognitive and motor performance equivalent to legally prescribed levels of alcohol intoxication. Occup Environ Med 57: 649 – 655**