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Accidents and Fatigue

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Numerous laboratory studies have demonstrated that sleep deprivation causes both declines in alertness and performance (e.g., Bonnet and Arandt 1994, 1995, Barabsky and Pigeau 1997, Dinges et al. 1994). While the association between sleepiness and performance has been well established through laboratory studies, using a variety of performance tests such as simple reaction time tests, vigilance tests and more complex cognitive tests (e.g., Performance Vigilance Task - PVT, Walther Reed Performance battery, flight and driving simulators), this relationship has been somewhat less studied in real workplace situations using work-related performance output measures (e.g., classical analysis by Bjerner et al. 1955). However, there is large body of research illustrating the link between fatigue and human errors/accidents in the workplace. For example, Hobbs and Williamson (2003) showed that fatigue is a contributing factor to errors of aircraft maintenance personnel. An accident study by the National Transportation Safety Board (NTSN 1995) concluded that fatigue was the probable cause in 58% of single-vehicle truck accidents. While the above and similar studies directly link errors/accidents to fatigue, many other studies add indirect support through findings of increased accidents and injuries at nighttime as compared to day work (e.g., Shannon et al. 1993, Akerstedt 1994, Smith et al. 1994, Horwitz and McCall 2004). Recent studies on medical interns, conducted by the Harvard Work Hours, Health and Safety Group, linked long work hours to sleep, attentional failures, medical errors and motor vehicle crashes (Landrigan et al. 2004, Lockley et al. 2004, Barger 2005).

Some of the largest industrial accidents such as the disasters at the nuclear power plants in Three Mile Island and Chernobyl or the chemical plant in Bhopal have been directly linked to fatigue (Moore-Ede 1992). In transportation, fatigue is viewed as the Number One safety problem. The yearly costs to society of fatigue-induced accidents and production losses in the US total billions of dollars per year (Dinges 1995; Moore-Ede 1992; Folkard et al. 1999), and these costs are rising with increasing economical exploitation of the 24-hour window. Acknowledging the association between fatigue/sleepiness and human error-related accidents and their increasing risk, Dinges (1995) concluded in his comprehensive review of this topic that “fatigue management and prevention of fatigue-related catastrophes need to become a sustained priority for government, industries, labour, and the public.”

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Fatigue management approaches can include a variety of interventions, such as education, work scheduling, and technological approaches (e.g., alertness monitoring or the fitness-for-duty testing). Fatigue management interventions can help reduce accident rates, as demonstrated by a recent study on truck drivers (Moore-Ede et al. 2004). The long-term goal of the technology development proposed here is to become integral part of such fatigue management systems, and help minimize workplace errors/accidents.

Landrigan CP, Rothschild JM, Cronin JW, Kaushal R, Burdick E, Katz JT, Lilly CM, Stone PH, Lockley SW, Bates DW, Czeisler CA: Effect of reducing interns' work hours. on serious medical errors in intensive care units. N Engl J Med 2004, 351 (18), 1838-1848.

Lockley SW, Cronin JW, Evans EE, Cade BE, Clark MS, Landrigan CP, Rothschild JM, Katz JT, Lilly CM, Stone PH, Aeschbach D, Czeisler CA: Effect of Reducing Interns' weekly work hours on sleep and attentional failures. N Engl J Med 2004, 351 (18), 1829-1837.