Sleepy Driving

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• Sleep apnea

SLEEPINESS AND DRIVING: A BRIEF REVIEW

Although the exact neurophysiologic mechanisms of sleep remain to be elucidated, there is ample scientific evidence identifying that adequate sleep is essential for healthy daily functioning and general well being.[1] Insufficient sleep may cause decrements in health and quality of life. Acute and chronic sleepiness is pervasive in our society and is generally the result of volitional insufficient sleep (sleep dept), or is secondary to an underlying sleep disorder such as obstructive sleep apnea (OSA) syndrome, narcolepsy, or insomnia.[2–6]

Regardless of the causes of sleepiness, driving while drowsy, tired, sleepy, or fatigued can result in human-error–related accidents and injuries due to decrements in neurobehavioral functions. These decrements may negatively affect reaction times and vigilance to such a degree to cause a motor vehicle accident.[7] Due to the large number of drivers on the United States highways, human-error accidents caused by sleepiness are of grave concern for public health and safety.[8–13] The National Transportation Safety Board (NTSB) reported in 2004 that there were 291 million individuals in the United States. Approximately 191 million were licensed to drive and of these about 42,000 die yearly in traffic-related accidents.[14] The National Sleep Foundation (NSF) "Sleep in America Poll" found that 51% of adult drivers polled admitted to driving drowsy and 17% reported falling asleep at the wheel in the previous year.[15] The prevalence of sleepiness in our society has been reported to be as high as 33%.[3,16] Hence, there is an immense pool of sleepy driving subjects, many of whom ignore or are oblivious to the signs of sleepiness and continue to drive. Some of the most common unambiguous behavioral signs of sleepy driving are: single or repetitive head drops (called microsleeps = lapses of $\geq$500 ms), heavy eyelids with frequent eye closures, and yawning. These signs are often ignored by the driver and as a result a sleepy accident could occur. It has been reported that subjects who fell asleep while driving usually knew they were experiencing fitful levels of sleepiness beforehand.[17] However, sleepy drivers are generally unable to predict when their sleep impairment has escalated to a point where sleep will overtake them without notice.[18] Unfortunately, at present there is no objective method to evaluate an unfit driver due to sleepiness alone.

BRIEF HISTORY OF SLEEPINESS

The peer-review literature is replete with years of data collection on the dangers of sleepy driving.[19–21] Many of these investigations suggest countermeasures and educational programs for drivers.[22–24] This approach has merit, but has not been widely implemented and unfortunately sleepy driving behavior still persists at high levels.[15] Hundreds of government and medical investigations concerning sleepiness and driving have

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been published, yet they have either not reached the public and health care providers or they have not been given adequate attention. Therefore, a disconnect exists between the published information available and the level of understanding among the population as a whole. In fact the public's understanding of sleep in general lags far behind the advances reported in the scientific literature. This gap needs to be improved.

What Was Previously Accomplished?

To emphasize that much has been uncovered about sleepiness, a literature search of Medline (PubMed) and Ovid databases was conducted. Key words used in the search strategy included: drowsiness, sleepiness and accidents, drowsiness and accidents, drowsiness and driving, sleepiness and driving. Non-English articles that had an abstract in English were included in the overall number count. Peer-reviewed articles dating from the early 1920s (Ovid) through the present day were included in the survey (PubMed goes back only to 1950) (**Fig. 1**). Two early examples are presented so the reader can fully appreciate that investigations of sleepiness have been around for many years. In 1921, McComas[25] reported on the effect of altitude on a subject flying in an airplane at up to 20,000 feet. Although not a driving experience per se, he examined lowered oxygen tensions as related to human motor mechanism activity, impaired vision, early fatigue, and coordination disturbances. The subject underwent 50 tests each at 4 different altitudes. The outcomes suggested that there were alterations of higher brain functions along with drowsiness and irritability. In 1938 Mayer[26] reported on the human factor in the prevention of (French) traffic accidents. He noted in part that 77% of traffic accidents were due to psychological factors secondary to a lack of attention, fatigue, drowsiness, and/or imprudence.

What Have We Now Accomplished?

An excellent review article by Ellen and colleagues[27] reported on motor vehicle crash risks in sleep apnea. The objective was to determine if drivers with sleep apnea have an increased risk of motor vehicle accidents and if sleep apnea severity and excessive daytime sleepiness (EDS) could affect driving risks. Forty-one evidence-based medicine studies of noncommercial drivers with sleep apnea were identified. A 2- to 3-times greater crash rate was identified in this group at a statistically significant level. Commercial drivers had comparatively smaller crash rates. Approximately 50% of the studies included in the review showed an increased risk for crashes with increased OSA severity, whereas the remaining

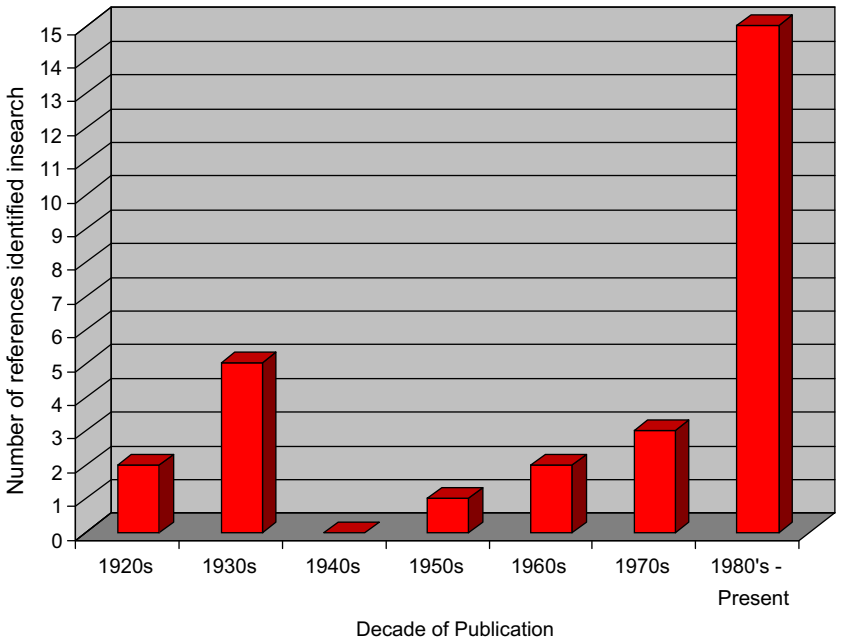

Fig. 1. November 2009 search results of Ovid and PubMed databases using the key words "drowsiness," "sleepiness," "drowsiness AND accidents," "sleepiness AND accidents," "drowsiness AND driving," and "sleepiness AND driving." The numbers of articles identified for a given decade are given on the Y-axis and their decade of publication on the X-axis. After 1980, more than 10,000 references were identified.