



Inattention is a consequence, not a cause:

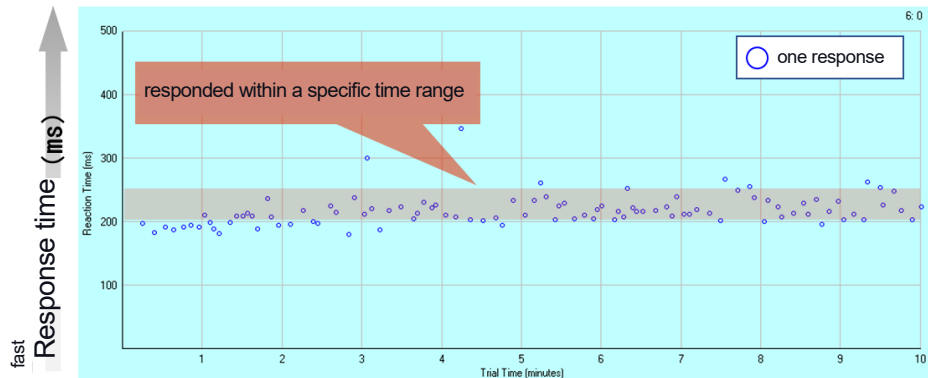
Chronic sleep deprivation situations don't prevent dozing!

Concerning the theme of "accidents caused by dozing", we appreciate having given contributions from Tomohide Kubo, Shun Matsumoto, Hiroki Ikeda and Yuki Nishimura of the Field Intervention Team, Research Center for Overwork-Related Disorders, National Institute of Occupational Safety and Health, Japan.

Some readers may believe that dozing is due to "not paying enough attention" or "laziness". You may even hear managers or supervisors giving such guidance. However, this needs to be corrected. Dozing is a physiological phenomenon bound to occur, incredibly when sleep is chronically challenging to come by on the job. When we lack sleep, our brain spontaneously tries to preserve its function by dozing.

Figure 1 shows the results of the Psychomotor Vigilance Task (PVT test), a nationally and internationally renowned test for sleepiness. The test lasts 10 minutes each time. It is a simple reaction time test in which the subject is required to press a button as soon as possible to stop the digital counter on the display when it starts counting. However, as you never know when the digital counter will start counting, you are required to keep your eyes on the display at all times. This makes it very tedious and drowsy, but because it is a simple test, it is used nationally and internationally as a very high indicator of sensitivity to drowsiness. Figure 1 shows the elapsed time of the 10-minute test on the horizontal axis and the reaction time when the test subject can stop the button on the vertical axis. In this way, the subject can press the button and stop at a constant speed for 10 minutes when he is not tired, whereas when he is tired or sleep deprived, there is a more significant variation in pressing the button earlier or later for the same 10-minute test time.

Low fatigue



High fatigue

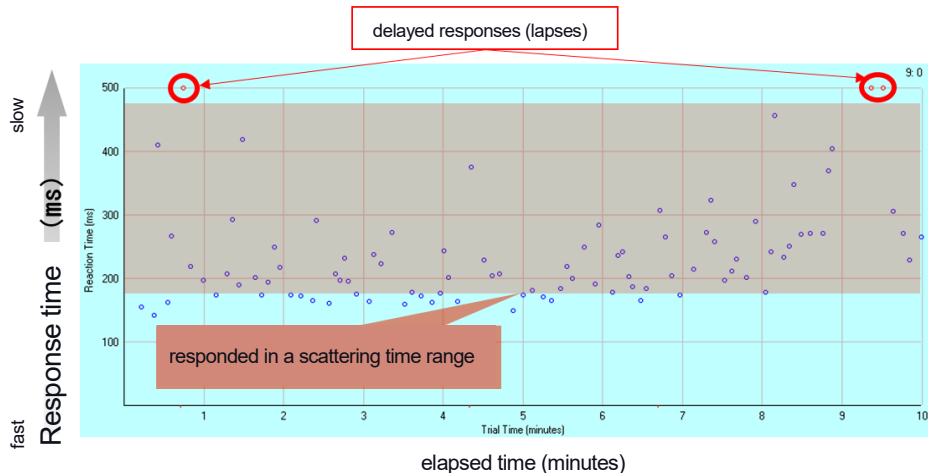
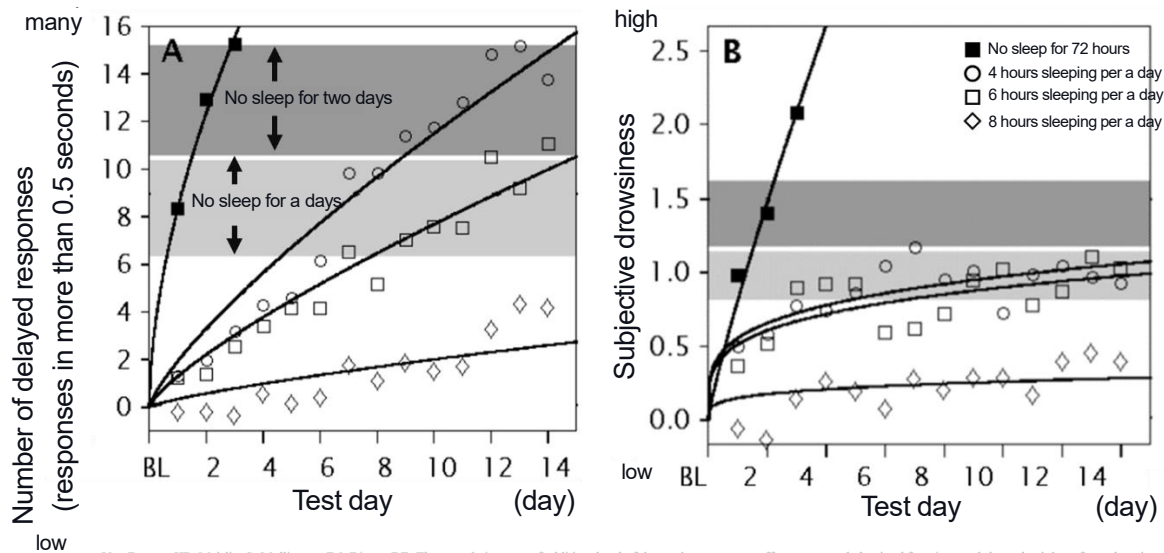


Figure 1 Results of the reaction time testing task (Psychomotor Vigilance Task)

As these results show, when we become tired, our brain functions are less able to maintain constant attention. In addition, button presses after more than 0.5 s are called delayed responses (lapses), indicators of momentary dozing; the delayed response circled in red in Figure 1 appeared three times in ten minutes. It shows that we cannot control the onset of dozing by our willpower alone, especially in sleep-deprived situations.



Van Dongen HP, Maislin G, Mullington JM, Dinges DF. The cumulative cost of additional wakefulness: dose-response effects on neurobehavioral functions and sleep physiology from chronic sleep restriction and total sleep deprivation. *Sleep*. 2003 Mar 15;26(2):117-26. doi: 10.1093/sleep/26.2.117. Erratum in: *Sleep*. 2004 Jun 15;27(4):600. PMID: 12683469.

Figure 2. Chronic sleep deprivation and poor performance

Figure 2 shows the results of an experiment using this PVT test, which clearly illustrates the frightening of chronic sleep deprivation. In addition to staying up all night for three days (72 hours), there were four conditions of sleeping, four hours a day, six hours a day and eight hours a day for 14 days, with several dozen subjects participating in each experimental condition. The left chart shows the results of the PVT test, and the right graph shows the results of subjective drowsiness, with higher values on the vertical axis indicating poorer performance respectively.

First, the results of the PVT test on the left graph show that the average number of delayed responses when a person stayed up all night a day is about eight, the same as when a person slept 4 hours a week. And as well the average number is 11 when a person stayed up all night for two days, the same as when a person slept 4 hours for ten days. This result shows that if you didn't get enough sleep, you would eventually stay at the same level of attention as if you had stayed up all night. Even more frightening is the interpretation when compared to subjective sleepiness. The objective test, the PVT test, shows that the maximum performance level is equivalent to those who stayed up all night for two days, while subjective drowsiness does not reach the level of those who stayed up all night for two days, even after getting repeated short sleep periods. In other words, when people are chronically sleep deprived, even if they think they are not sleepy, their work performance is at the same poor level as if they had stayed up all night. The lesson learned from this is that you cannot ignore the effects of chronic sleep deprivation in industries where a single mistake can lead to fatal accidents or injuries.

Therefore, managers and supervisors should be aware that the prehistoric occupational health and safety management theory, "the carelessness of the worker causes accidents!" can never prevent accidents caused by dozing. Inattention is not a cause but a consequence. If employees are to do their duty on work shifts that do not allow them to get enough sleep, dozing will occur as a human physiological phenomenon, depending on the individual.

The most important message from us to the readers in this column is that the first and foremost step to prevent accidents caused by dozing is not to rely on the efforts and perseverance of individual workers, but to review the way they work, focusing on the arrangement of breaks and days off.