Editorial

Searching for the Countermeasure of Night-Shift Sleepiness

Comment on Schweitzer PK; Randazzo AC; Stone K et al. Laboratory and field studies of naps and caffeine as practical countermeasures for sleep-wake problems associated with night work. SLEEP 2006;29(1):39-50.

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SHIFT WORKERS COMPLAIN AS MUCH ABOUT SLEEPINESS AS THEY DO ABOUT DISTURBED SLEEP.1 SLEEPINESS IS PARTICULARLY SEVERE ON THE NIGHT shift, hardly appears at all on the afternoon shift, and is intermediate on the morning shift. The maximum level of sleepiness is reached toward the early morning (5:00 AM to 7:00 AM). Incidents of falling asleep are also frequently reported. At least two thirds of respondents report that they have experienced involuntary sleep during night work.

Ambulatory electroencephalographic recordings verify that incidents of actual sleep occur during night work in, for example, process operators.2 Other groups, such as train drivers,3 truck drivers,4 medical interns,5 and pilots6 have shown clear signs of falling-asleep incidents while working at night. This occurs toward the second half of the night and appears as repeated bursts of alpha and theta electroencephalographic activity, together with closed eyes and slow undulating eye movements. As a rule, the bursts are short (1-15 seconds) but frequent and seem to reflect letdowns in the effort to fend off sleep.

The sleepiness reported is also reflected in reduced performance capacity at work, even if the number of studies that have actually demonstrated this finding is modest.7 The effects on safety are actually more well documented.7 In particular, operating vehicles is clearly associated with an increase in risk during, for example, night driving.8 The National Transportation Safety Board has stated that 15% to 30% of the accidents in the transport sector are due to fatigue.9 Accidents in industry are far less well documented, even if a few studies have found increased risk during the night shift.10 Mega-accidents like, for example, the nuclear accidents in Harrisburg and Chernobyl11 are often cited as evidence of the great risk of night work in industry, but the causal chain in those disasters is rather weak. On-call work has, however, recently been demonstrated to be associated with an increased level of medical mistakes,12 as well as with accidents driving home from on-call work.13

In any case, there is enough evidence that sleepiness due to night work is associated with increased fatigue or sleepiness and constitutes a clear safety risk in some occupations. As a consequence, the issue of countermeasures to night-work sleepiness has, for a long time, been attracting attention. Thus, for example, there is a plethora of studies on how to optimize work schedules,14 but it has never been convincingly demonstrated that there is a schedule that would largely eliminate night-shift sleepiness, even though there is clearly a case for certain work-schedule characteristics being particularly conducive to sleepiness. Among them are short rest between shifts and many night shifts in succession.

Other types of countermeasures involve different types of interventions, such as sleep strategies, drugs, and environmental stimulation.15 Perhaps the most obvious acute countermeasure is physical activity. It has never been systematically evaluated as a countermeasure, but those who have carried out field studies of shift workers will have noticed how workers with sedentary jobs start moving about when they become sleepy.

Another, somewhat unusual, approach to countermeasures against tired truck drivers was devised by Landström et al16 who constructed a noise generator that suppressed sleepiness by delivering random bursts of unpleasant noise. The same authors also tried intermittent rapid (1-minute) reduction of cabin temperature by 5 degrees and found it to be efficient but too unpleasant to be supported by drivers.17 More-gradual temperature reduction does not seem to be efficient, however.18 Listening to the radio while driving does not seem to be efficient but seems to have been evaluated only in simulated driving.19

Light therapy for shifting the circadian system has, for a long time, been promising in laboratory studies,19 but very few studies of real-life shift work have been carried out, and, while the results are positive,20,21 the effects on test performance or sleepiness are relatively modest.

Napping constitutes the most natural countermeasure against sleepiness, and there exists a considerable documentation on its usefulness during simulated night work (see the paper by Schweitzer et al22 for a review). Real-life studies are much less common, but the few intervention studies that have been carried out seem encouraging,23,24 alertness and performance capacity increase.

Caffeine has been the other established antidote to sleepiness, and its ability to counteract sleep is well documented, again, in simulated shift work (see the paper by Schweitzer et al22 for a review). In a recent study,25 caffeine consumption was found to be as effective as modafinil and dextroamphetamine in countering sleep loss. However, there have been no systematic studies of the use of caffeine in real-life shift work, and such a study is obviously needed. This is one of the reasons why the paper by Schweitzer et al22 in this issue of SLEEP is extremely welcome. But, even more important is the innovative approach of combining caffeine with napping. The idea of combining countermea-

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ures is very attractive because this has the potential to increase the alerting effects but may also be used to avoid high doses of, for example, caffeine.

The study by Schweitzer et al is important also because it represents a step out into the real world in which the application lies. Much shift-work research has long suffered from the strong preferences of researchers to remain in the comforts of the laboratory. The reason is, of course, the difficulty of controlling possible confounders. But this also results in skepticism among the potential users. Thus, the conclusions of the Schweitzer et al paper will clearly have impact. The combination of caffeine with a nap apparently works, is simple, and can be implemented with a minimum of organization. It may also reduce the need for high levels of caffeine intake, which often characterize shift workers. Also, one may not have to use more-potent and expensive drugs like, for example, modafinil, which has been demonstrated to have similar effects in shift workers brought into the laboratory.

Still, a field study is a field study, with all its pitfalls of interpretation. There are a number of possibilities for confounders to affect the results. The reader does not get sufficient information of such possibilities. Thus, one might criticize the lack of information about type of work (too diverse to describe?), type of schedules worked (too diverse to describe?), and the social situation (children, marriage, living conditions). One may also wonder about the effects of the recruitment procedure and how the participants managed to set aside time for taking the tests and what may have been the effect of habitual “background” caffeine intake.

One may also wonder if the effects are not a little bit too modest to be of practical importance. The subjective ratings and the effects on the Psychomotor Vigilance Test clearly suggest that the intervention did not come close to achieving normal daytime alertness levels (which was acknowledged by the authors). It doesn’t really seem likely to affect, for example, accident rate. But, this observation is not unique. For example, in studies of hypnotics, new substances shown to improve sleep may give 30 minutes of extended sleep—hardly a major impact. This raises the question of what level of improvement is important: can criteria be established?

But, the study by Schweitzer et al is the first of its kind and will, no doubt, be followed up by other studies on different doses and timings of naps and caffeine—maybe midshift administration of both would enhance effects? Maybe reduction of caffeine intake outside night shifts will also enhance effects. One also needs to test effects against different habitual levels of caffeine and to follow the use of countermeasures across months of use. Also, gastrointestinal function and long-term effects on the autonomic nervous system of the use of caffeine need to be addressed. One would also like to see additions to the combined countermeasure approach, for example, using light treatment. As often is the case, the present paper provides more questions than answers.

REFERENCES