The Somnificity of Different Activities Described in the Epworth Sleepiness Scale

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Introduction:

The concept of somnificity was introduced by Johns in 2002 (1). It refers to the tendency or capacity of a particular posture, activity and situation to induce sleep-onset in the majority of subjects. Somnificity is not a characteristic of subjects. It addresses the self-evident fact that we are much more likely to fall asleep lying down that standing up, regardless of the time of day or how long we have been awake.

Aim:

The aim of this study was to demonstrate that the concept of somnificity has widespread application.

Methods:

A population-based sample of 614 subjects from USA (male and female, black and white, aged 36-48 yr) who were taking part in the CARDIA study answered the Epworth Sleepiness Scale (ESS) and repeated it a year later (2). A separate group of 990 subjects in Australia (sleep clinic patients, students and industrial workers, male and female, aged 17-78 yr) answered the ESS once as part of other investigations (1). Total ESS scores ranged between 0 and 24 in both the US and Australian groups.

The eight items of the ESS include brief descriptions of different activities, with different postures (lying down or sitting), different social contexts (alone or with others), and different environments (in a public or private place). ESS item-scores refer to the subject's chances of dozing off in those different situations as part of their usual way of life, scored on a 4-pt scale (0 = not at all, 3 = a high chance).
Each subject's item-scores were ranked from highest to lowest, 8 to 1, with ties assigned their mean rank. This removed the considerable differences in average sleep propensity between subjects. Statistical differences between item-ranks were tested by Wilcoxon's matched pairs t-tests.

References
1. Johns MW. Sleep propensity varies with behaviour and the situation in which it is measured: the concept of somnificity. *J. Sleep Res*, 2002;11:61-67.
2. Lauderdale DS, Knutson KL, Rathouz PJ, Yan LL, and Liu K. Stability of the Pittsburgh Sleep Quality Index and the Epworth Sleepiness questionnaires over one year in early middle-aged adults: The CARDIA Study. *Sleep*. 2005; 28: Abs Suppl.A320-321.
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Results:

In the US group, item-ranks were significantly different ($p<0.001$) for all items except 3 and 7 (Table 1). In the Australian group, item-ranks differed ($p<0.001$) for all items except 3 and 7 ($p>0.1$) on the one hand, and 6 and 8 on the other ($p>0.5$). Overall, the results were very similar in both countries.

The activities described in the ESS items formed an ordinal scale of somnificities with six levels that differed significantly from each other ($p<0.001$) (Table 2). The scale was the same for US whites as for blacks, and the same when the ESS was repeated a year later. Item 5 had the highest somnificity. Items 2, 1 and 4 had progressively lower somnificities. Items 7 and 3 were next lowest and did not differ from each other ($p>0.1$). Items 8 and 6 differed slightly from each other in the US sample but not in the Australian sample ($p>0.1$). They had the lowest somnificity.

"Sitting and talking to someone" (Item 6) was consistently less somniferous than "sitting and reading" (Item 1) ($p<0.001$). There must be subtle differences in wake-promoting activity (wake-drive), and hence in sleep propensity, associated with sitting, talking and relating to another person that are not present when sitting and reading. "Lying down to rest in the afternoon when circumstances permit" (Item 5) was consistently more somniferous than all other activities ($p<0.001$). This may be because the other activities usually involve sitting rather than lying down.

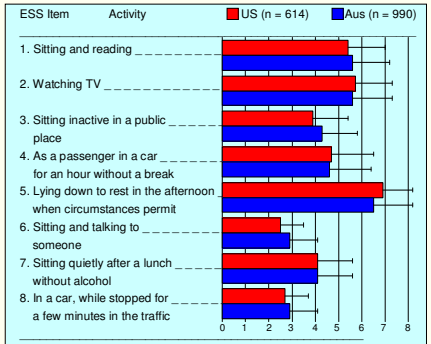

Table 1. The mean and standard deviation of ESS Item-ranks in US and Australian subjects.

Within each group, Items 3 and 7 did not differ significantly ($p>0.1$). There was a small but statistically significant difference between Items 6 an 8 in the US group ($P<0.001$), but not in the Australian group ($p>0.5$). All other Items differed significantly from each other ($p<0.001$).

ESS Item	
Highest Somnificity	
5	Lying down to rest in the afternoon when circumstances permit
2	Watching TV
1	Sitting and reading
4	As a passenger in a car for an hour without a break
7	Sitting quietly after a lunch without alcohol
3	Sitting, inactive in a public place
8	In a car, while stopped for a few minutes in the traffic
6	Sitting and talking to someone
Lowest Somnificity	

Table 2. Scale of six significantly different levels of Somnificity ($p<0.001$), from highest to lowest, based on ESS Item-ranks in US and Australian subjects.

Conclusions:

The ordinal scale of somnificites reported here was remarkably constant and appears to be widely applicable in USA and Australia, across age, gender and race. The results are also in general agreement with those from several other countries reported previously (1).

The scale of somnificities enables major influences on sleep propensity to be quantified in relative terms for the first time. These influences are in addition to the time of day and the duration of prior wakefulness, and are at least as important as the latter. They must be included in any future model of sleep and wakefulness (3).

Somnificity is not a function of normal or excessive daytime sleepiness (because of sleep disorders) within individual subjects.

The psychophysiological mechanisms that underlie differences in somnificity require investigation. However, they clearly involve enteroceptive sensory inputs (e.g. from postural muscles) as well as exteroceptive inputs (e.g. environmental light and noise), that presumably effect sleep propensity by changing the wake drive more than the sleep drive.

Sleep propensity cannot be measured accurately without reference to the subject's posture, activity and situation at the time.

Total ESS scores reflect a person's average sleep propensity in daily life across a variety of situations that differ in their somnificity.