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POMS after driving (SD:  $3.5 \pm 0.8$  (Mean  $\pm$  standard error), NSD:  $-11.8 \pm 3.2$ ,  $P = 0.013$ ). Subjective sleepiness (KSS) was significantly increased after sleep restriction: All sleep deprived subjects demonstrated a moderate level of sleepiness with an average KSS score of  $3.7 \pm 0.5$  before and a slightly higher score of  $4.8 \pm 0.6$  after driving. On an objective level, subjects showed significantly slower mean reaction times in both sustained attention tasks after the driving sessions, when they were sleep deprived (PVT SD:  $241.5 \pm 10.8$  ms, NSD:  $225.1 \pm 5.1$  ms,  $P = 0.028$ ; Mackworth Clock SD:  $.533 \pm 0.021$  sec, NSD:  $0.522 \pm 0.021$  sec,  $P = 0.042$ ).

For driving efficiency, sleepy drivers had a significant higher fuel consumption: Mean diesel fuel use increased by an average of 1 litre/100km (from  $37.6 \pm 0.48$  litre in the control condition to  $38.6 \pm 0.51$  litre in the sleep deprived condition;  $P = 0.035$ ). Besides, the drivers used the Automatic Cruise Control (ACC) significantly more often, when sleep deprived: SD:  $25.3 \pm 2.3\%$ , NSD:  $20.4 \pm 2.9\%$ ;  $P = 0.042$ ).

**Conclusion:** We observed increased fuel consumption due to consequences of sleepiness even in very experienced drivers despite their training expertise in economic driving. Thus, as fuel is the single biggest variable for every transport operation, even a minor improvement in fuel economy can lead to massive savings.

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## O289

### Sleep evaluation in car passengers using a seat head hammock new device

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Prospective, crossover, randomised, single-blind study (NCT01062295) to perform an objective and subjective assessment of sleep in car passengers using a new device (Siesta-System<sup>®</sup>, under patent evaluation: WO 2009118432) that works as a seat head hammock. Forty volunteers ( $43.5 \pm 0.1$  years old) participated in this study. Exclusion criteria were: acute or severe chronic disease or any related with sleep, pregnancy, Body Mass Index  $> 40$ , consumption of alcohol  $> 15$  grams or any excitant drinks on the day of testing. All participants underwent a medical examination and were questioned on sleepiness, clinical history, drug use and sleep habits. They signed an informed consent approved by the Txagorritxu Hospital Scientific Committee. Volunteers went on two car journeys in the same night riding in the front passenger's seat: Control journey with normal headrest, and Treatment journey using the seat head hammock. Both journeys performed an identical itinerary lasting 105 min. separated by a 15-min. break. They were carried out in a randomized order generated by computer software and kept blind to researchers. Conventional polysomnographic recordings with an ambulatory system were conducted during journeys. At the end of the session, volunteers answered questionnaires for each journey about subjective perception of rest, sleep and neck discomfort. Seat head hammock system compared to normal headrest increased sleep efficiency ( $P = 0.001$ ) and percentage of N3 and REM sleep ( $P = 0.007$ ), shortened sleep latency ( $P = 0.004$ ) and improved participants' scores on all subjective perception questionnaires ( $P < 0.001$ ). There was no period effect for any variable. Few studies have been conducted on sleep in positions other than lying down. Those that have been done have shown that

sleep is possible in up-right or sitting positions but it is shorter and poorer quality. To our knowledge, no studies have been conducted about sleep in a sitting position while in motion, as it happens with vehicle passengers. According to our results, objective and subjective sleep are improved using Siesta-System<sup>®</sup>. Further studies will be performed to assess neck postural health using this new device in comparison to a normal headrest. To get a good rest in a vehicle while maintaining a healthy neck position is important for those who have to travel frequently or for professional second drivers.

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## O290

### From polysomnography to sleep parameters indexing sleep quality and sleep-related physiological and psychometric factors

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**Objectives:** For two considered whole-night sleep models we aimed at extracting new sleep parameters providing objective indexing of sleep with respect to selected sleep quality and daytime physiological and psychometric measures.

**Methods:** We analyzed polysomnographic data from 148 healthy individuals spending two nights in the sleep lab. Subjects performed several tests for assessment of attention, concentration, memory, fine motor activity, drive, affectivity, drowsiness and mood. The tests were carried out under strictly the same conditions in the morning as well as in the evening. Systolic and diastolic pressure and pulse values were recorded. All subjects filled out several questionnaires scoring their subjective well-being, sleep and awakening quality. First, we used factor analysis to uncover the latent structure of a selected set of 22 test variables. The extracted factors represented new indexes of subjective and objective evaluation of sleep quality and day-time behavior. Second, we constructed a continuous sleep representation by considering the probabilistic sleep model (PSM). Using the model, 325 objective sleep parameters describing quantitative and qualitative characteristics of the probabilistic sleep profiles were computed. The same procedure was repeated for the Rechtschaffen and Kales (R&K) sleep model. In this case 109 sleep parameters were extracted. Both sleep models were compared by considering their ability to reveal a higher level of statistically significant correlations between sleep parameters and factors.

**Results:** The factor analysis revealed three dominant factors. The factors grouped variables reflecting subjective sleep quality, physiological measures and psychometric test results. The physiological and psychometric factors showed significantly higher levels of correlation with sleep parameters when tested against individual variables they consist of. For both factors the R&K sleep parameters provided only limited and in values smaller correlations in comparison to the PSM.

**Conclusion:** The presented concept of grouping a wider set of different sleep quality, physiological or behavioral measures into a smaller parsimonious set of not directly observed latent variables should be considered when searching for robust sleep indexing. The standardized scoring of sleep into a set of discrete R&K sleep stages may not be sufficient to reveal important sleep changes related to such indexes. The PSM represents a promising alternative.

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