

Hyperarousal as a Basis for Chronic Insomnia: Statistical Misconceptions and Individual Differences

Michael Varkevisser, PhD¹; Hans P. A. Van Dongen, PhD²; Gerard A. Kerkhof, PhD³

¹Department of Industrial Design Engineering, Delft University of Technology, Delft, The Netherlands; ²Sleep and Performance Research Center, Washington State University, Spokane, WA; ³Department of Psychology, University of Amsterdam, Amsterdam, The Netherlands; and Centre for Sleep and Wake Disorders, MCH Westeinde, The Hague, The Netherlands

DEAR EDITOR,

IN AN EDITORIAL IN A RECENT ISSUE OF THE JOURNAL SLEEP, BONNET¹ TOOK ISSUE WITH OUR STATISTICAL ANALYSES OF PHYSIOLOGIC MEASURES OF hyperarousal in chronic insomniacs and healthy controls studied under constant routine.² He stated that cursory examination of our figures revealed that “heart rate was consistently elevated by 4 to 6 beats per minute in 9 of 9 observation periods throughout the 24-hour experiment in insomnia patients compared with controls. Such a finding is similar to flipping heads 9 consecutive times with a fair coin and has the exact binomial probability of $p = .002$.”¹ However, this statement is incorrect, as it fails to account for the standard errors associated with the group-average curves shown in our figures (Figure 2, lower panels),² as well as the serial correlations inherently present in repeated measures.³ More-accurate statistical results were provided in our paper (Table 3).² These results showed that the comparisons between insomniacs and controls were not statistically significant.

Of course, statistical significance is a function of sample size. Bonnet stated that “with an effect size of 1.0 and a sample size of 11 insomnia patients, the odds of Varkevisser et al obtaining a statistically significant result at the .05 2-tail level is 61%.”¹ Actually, our tests were appropriately 1-tailed and involved an overall sample size of $N = 24$, but the more important error in Bonnet’s statement is his assumption that one could perform meaningful power calculations using solely the data of interest. On the contrary, power calculations should be based on preliminary data or on results published by others (see ref. 20 in Bonnet¹). Such power calculations were provided in our paper.² These showed that there would have been ample power to demonstrate, with statistical significance, any real group differences in physiologic measures of hyperarousal. Contrasts between our findings and other reports in the literature should probably not be explained in terms of statistical power but, rather, in our use of the constant routine paradigm. As such, our negative findings were not necessarily at odds with

earlier papers documenting positive findings. Rather, the absence of differences in physiologic indexes of hyperarousal between insomniacs and controls during constant wakefulness suggested that hyperarousal in insomniacs may be specifically associated with the sleep period.²

Bonnet made a good point about subject selection as a tool to maximize group differences and minimize variability.¹ In order for research findings to have practical relevance, however, it is important for selection criteria to be consistent with inclusion and exclusion criteria normally used in clinical practice—which was the case in our study. Interestingly, there were overwhelming, systematic interindividual differences in the measures of hyperarousal (Table 5)² among the insomniacs as well as the controls. Since insomniacs appear to constitute such a heterogeneous group,^{2,4} even under strict selection criteria and controlled laboratory conditions, it may be pointless to argue about the potential statistical significance of comparatively small elevations in hyperarousal indexes. We should realize that much more work needs to be done before we truly understand the basis for chronic insomnia.

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Address correspondence to: Michael Varkevisser Ph.D., Department of Industrial Design Engineering, Delft University of Technology, Landbergstraat 15, Delft, 2628 CE, Netherlands, Tel: (+31) 15 278 4640; Fax: (+31) 15 278 7316; E-mail: M.Varkevisser@tudelft.nl