

Executive functions of interns after a night on call

Funções executivas em residentes após plantão noturno

Dear Editor,

Executive function (EF) is a set of cognitive abilities which permit the start of activities, planning, programming and sequencing of actions¹. Medical residency is generally acknowledged to be stressful, and thus interns are susceptible to fatigue and chronic sleep deprivation given their prolonged work hours and rotating work schedules². The importance of this question is illustrated by the increasing public and academic attention focused on the role of resident physicians' fatigue in the occurrence of medical errors, percutaneous needle sticks, laceration injuries and post-on-call motor vehicle crashes^{3,4}. A limit of 80 work hours per week was instituted in the USA in 2003⁵, but even with this regulation many studies have identified problems during residency. We aimed to compare the executive functions of Brazilian first-year internal medicine residents after a night on call in the emergency room (ER) and after a night off duty during training using neuropsychological tests. The study was approved by the Ethics Committee of the *Hospital Central da Irmandade da Santa Casa de Misericórdia de São Paulo* (process number 074/04). Thirty-eight out of the 40 first-year internal medicine residents

agreed to participate and gave written informed consent.

Exclusion criteria were as follows: substance abuse (alcohol or drugs); current use of medication known to affect the sleep/wake cycle or daytime alertness; neurological disease; attention deficit/hyperactivity disorder; lifetime history of traumatic brain injury/vascular brain disorder; severe, uncompensated sensory loss (deafness, muteness, or blindness); and participation in another medical residency program in the previous year. We included both residents during a normal shift at an internal medicine ward and residents who had not been on a night call for at least 72h.

The neuropsychological tests¹ used and the cognitive functions assessed are presented in Table 1. The assessments were performed for each resident twice in the morning immediately after the night on call (stage 1) and the night off duty (stage 2). There were at least eight weeks between the first and second evaluations. Differences between stages were tested with Wilcoxon test. Tests were two-tailed and results were considered significant when $p < 0.05$.

After a night on call, residents showed worse inhibitory control of impulses in the Stroop Color Test W ($p = 0.029$) and the Interference Effect Stroop ($p = 0.007$) than after a night off duty. In addition, also after a night on call, the residents had more perseverative errors in the Wisconsin Card Sorting Test ($p = 0.028$), showing worse cognitive flexibility (Table 1).

We recognize that it is difficult to design a study to evaluate the clinical implications of cognitive deficits. Therefore, we designed a study that combined several features. Importantly, we sampled a homogeneous group of doctors, relatively young, without previous work experience, who were their own controls (stage 2) and subject to the same workload, with the same number of working hours per week including night shifts (60h; work hour limit in Brazil) in contrast to those in many studies⁵. Our results highlight an issue that could be of interest to educators involved in training residents when planning their educational programs.

Table 1 – Cognitive performance of internal medicine residents after Stage 1 and Stage 2 (n=38)

Neuropsychological tests	Stage 1	Stage 2	p-values
	Mean (SD)	Mean (SD)	
Stroop Color Test D (seconds)*	16.38(7.057)	16.78(12.767)	0.381
Stroop Color Test W (seconds)*	17.95(7.721)	18.84(14.990)	0.242
Stroop Color Test C (seconds)*	23.54(7.225)	22.49(11.994)	0.029
Interference Effect Stroop **	6.02 (4.63)	3.48(8.06)	0.007
WCST – perseverative errors	1.87(4.938)	0.45(1.224)	0.028
WCST – failure to maintain set	0.11(0.388)	0.16(0.437)	0.608

*One resident was excluded in this analyses of this test (colorblindness) (n=37); WCST: Wisconsin Sorting Card Test; ** Interference Effect Stroop: Stroop Color Test C – Stroop Color Test W; Stage 1: after a night on-call; Stage 2: after a night off duty; SD = Standard deviation.

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* Modest

** Significant

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