COMPARISON OF THE SPANE AND PANAS SCALES FOR MEASURING SELF-REPORTED AFFECT DURING TOTAL SLEEP DEPRIVATION

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INTRODUCTION

Sleep loss leads to changes in self-reported affect and mood. In a study involving sustained sleep restriction to 4 hours per day, decreases in positive affect were found.[1] In two studies of total sleep deprivation (TSD), decreases in positive affect were observed as well[2,3]; one study also reported increases in negative affect.[3] The present study used the Scale of Positive and Negative Experience (SPANE) and the Positive and Negative Affect Schedule (PANAS) to measure subjective positive affect (PA) and negative affect (NA) during sleep deprivation.

The SPANE is a 12-item questionnaire with six questions measuring PA and six questions measuring NA. Each item is scored on a scale of 1 (very rarely or never) to 5 (very often or always). The total PA and NA scores on the SPANE each range from 6 to 30.[4] The PANAS is a 20-item questionnaire with ten questions measuring PA and ten questions measuring NA. Each item on the PANAS is scored on a scale of 1 (very slightly or not at all applicable) to 5 (extremely applicable to the way the individual is feeling). The total PA and NA scores on the PANAS each range from 10 to 50.[5] We examined changes in PA and NA during TSD and compared the results obtained with the two scales.

METHODS

Twenty-six healthy subjects (ages 22–37; 10 females) spent 6 consecutive days and nights in a sleep laboratory. All subjects had two baseline days with 10 hours time in bed (TIB) for sleep at night (22:00–08:00). They were then randomized to a 62-hour TSD condition (n=13) or a control condition with 10 hours TIB (22:00–08:00; n=13). All subjects subsequently had two recovery days with 10 hours TIB (22:00–08:00).

At 2-hour intervals during most of the scheduled waking periods in the study, subjects filled out a paper-and-pencil version of the SPANE, performed a battery of cognitive tests, and then filled out a computerized version of the PANAS. There were 42 test times in the TSD condition and 32 in the control condition. Each subject was asked to fill out the questionnaires according to how they felt at that moment.

Scores on the PA and NA subscales of both the SPANE and the PANAS were analyzed using mixed-effects analysis of variance (ANOVA) with a fixed effect of time and a random effect on the intercept over subjects. In these analyses, F tests for the effect of time were performed to assess the statistical significance of temporal changes. Additional analyses included mixed-effects ANOVAs with fixed effects of time, condition (TSD or control) and their interaction, or fixed effects of time, affect dimension (PA or NA) and their interaction, and a random

effect on the intercept over subjects. In these latter analyses, F tests for interaction were performed to assess the statistical significance of differential temporal changes between the TSD and control conditions or between PA and NA. For testing the interaction of time by condition, only test bouts included in both the TSD and control conditions were used.

One subject did not complete the last PANAS of the study and another subject did not complete the full set of NA items in one PANAS, resulting in a few missing data points. Our statistical analyses did not require imputation of these missing data.

RESULTS AND DISCUSSION

Figure 1 shows the group-average data for PA and NA as measured with the SPANE and PANAS in the TSD and control conditions of the study. Table 1 shows the results of statistical testing.

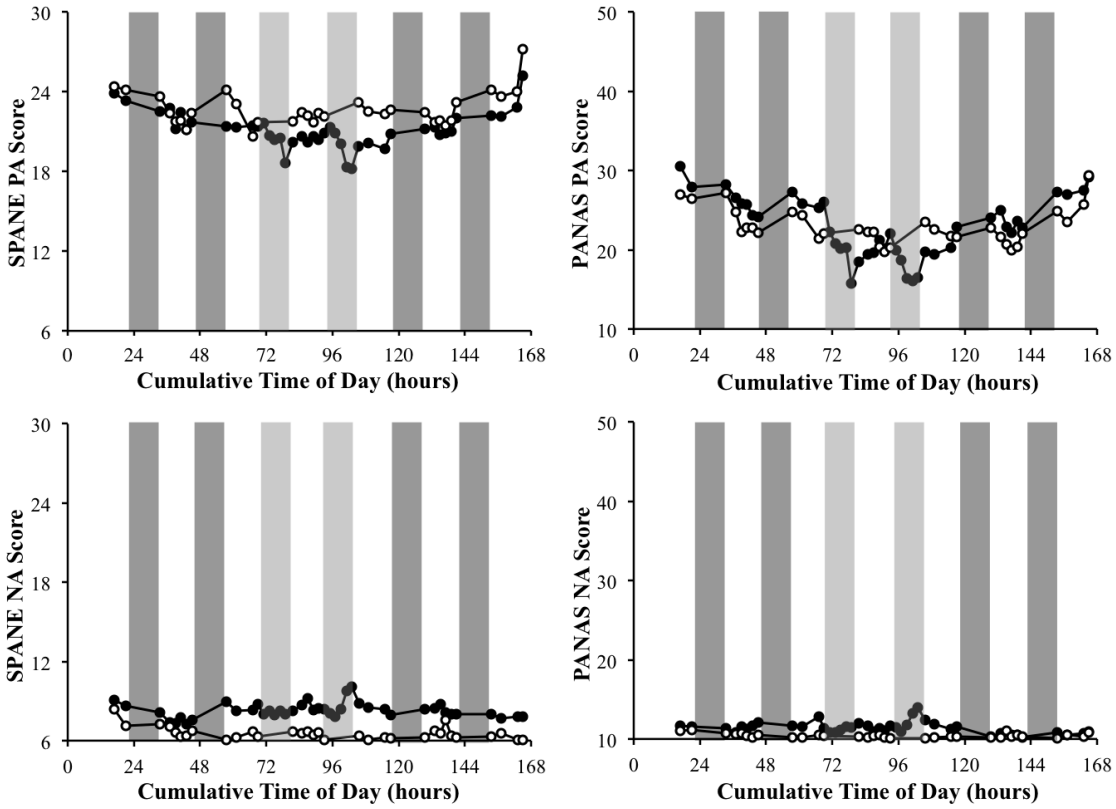

Figure 1. Group-average data for positive affect (PA; top panels) and negative affect (NA; bottom panels) on the SPANE (left) and PANAS (right) as a function of cumulative time of day in the study. Curves show the total sleep deprivation condition (closed circles) and the control condition (open circles); ttick marks indicate midnight. Dark gray bars represent TIB periods in both the TSD and control conditions. Light gray bars represent additional TIB periods in the control condition only.

For PA, there were significant effects of time for the SPANE and for the PANAS in the TSD condition and in the control condition. These results reflect marked decreases in PA during the TSD period – especially during the nights and early mornings. Although there were also decreases in PA during the middle days of the study in the control group, these were not as pronounced as in the TSD condition, as evidenced by significant interactions of time by condition.

For NA, there were likewise significant effects of time for the SPANE in the TSD condition and in the control condition. There was also a significant effect of time for the PANAS in the TSD condition, but not in the control condition. These results reflect that TSD was associated with minor increases in NA, as observed on both the SPANE and PANAS. However, these same increases were not seen in the control condition, as evidenced by significant interactions of time by condition.

The effects of the study on self-reported affect were more pronounced for PA than for NA on both the SPANE and the PANAS – see Figure 1. This observation was corroborated by significant interactions of time by dimension (PA versus NA), although in the TSD condition this interaction showed only a trend for the SPANE – see Table 1.

Table 1. Statistical effects of time, and interactions of time by condition and time by PA versus NA, as derived using mixed-effects ANOVA. df = degrees of freedom.

Dimension	*Instrument*	*Condition*	*F*	*df*	*P*
PA	SPANE	TSD	3.5	41, 492	<0.001
		control	3.9	31, 372	<0.001
		TSD versus control	3.1	31, 864	<0.001
	PANAS	TSD	9.4	41, 492	<0.001
		control	6.2	31, 371	<0.001
		TSD versus control	3.9	31, 863	<0.001
NA	SPANE	TSD	1.6	41, 492	0.017
		control	3.5	31, 372	<0.001
		TSD versus control	2.3	31, 864	<0.001
	PANAS	TSD	2.4	41, 491	<0.001
		control	1.3	31, 371	0.14
		TSD versus control	1.8	31, 862	0.004
PA versus NA	SPANE	TSD	1.4	41, 996	0.071
		control	1.8	31, 756	0.005
	PANAS	TSD	5.1	41, 995	<0.001
		control	2.0	31, 754	0.001

Across the TSD and control conditions, SPANE PA covaried significantly with PANAS PA ($F_{1,934}$=242.8, P<0.001) and SPANE NA covaried significantly with PANAS NA ($F_{1,933}$=28.6, P<0.001). The overall correlation between SPANE and PANAS was 0.55 for PA and 0.30 for NA. Thus, changes in PA and NA measured with the SPANE paralleled those measured with the PANAS fairly well. The correlation between the two scales was higher for PA than for NA, but this observation should be interpreted with caution, as there was more variability across the study (and thus greater potential for correlation between the two scales) for PA than for NA.

CONCLUSIONS

In this laboratory study, TSD caused a substantial drop in PA, especially at night and in the early morning, as observed on the SPANE as well as on the PANAS. In line with research showing independence of the positive and negative dimensions of affect,[4] the changes in PA during TSD were only marginally mirrored by changes in NA.

The relatively small magnitude of changes in NA during TSD would suggest that the subjects in our study did not experience the sleep deprivation period as particularly aversive. However,

in a recent laboratory study by another group,[3] which employed the Mood Scale II,[6] subjects exposed to TSD reported more substantively increased NA besides reduced PA. Subjects in the control condition of the study reported increased intensity of feelings of depression.[3] This suggests that increased NA may have been a symptom associated with the laboratory circumstances of that particular study per se, regardless of condition assignment. Findings of impaired performance in the absence of sleep loss reported by the same group,[7] not normally seen in the control conditions of sleep deprivation studies in other laboratories, would seem to support this explanation.

It is noteworthy that our findings contrast with reported changes in affect among medical residents exposed to sleep loss,[8] who have been found to exhibit both reduced PA and increased NA on the PANAS. The difference in the effect on NA may be related to the fact that the subjects in our study, unlike most medical residents, underwent sleep deprivation by voluntary choice alone.

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