Diurnal Cortisol Rhythms and Sleeping Patterns in Adolescence: A Longitudinal Study of the Transition to College

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Research Questions:

1)Are there concurrent associations between diurnal cortisol and sleeping during the first semester of college?

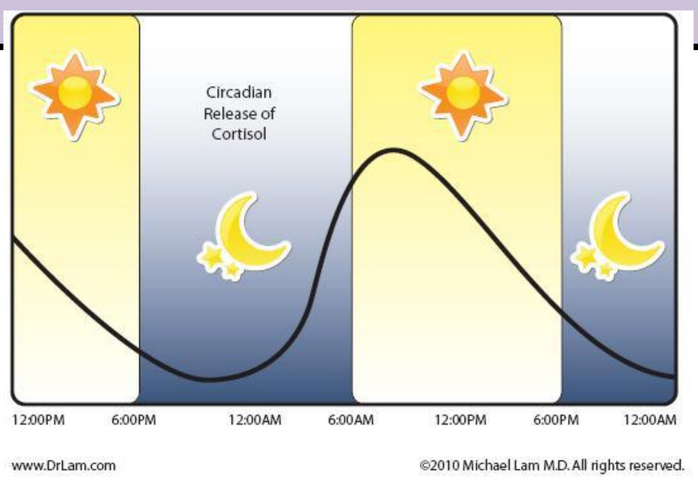
•Is the change in sleeping patterns over the transition to college associated with cortisol during the first semester of college?

Background:

➢Sleep is crucial for growth and development during pubertal years in children and adolescents. However, recent research has focused on adolescent sleeping patterns because of an emerging trend which illustrates that adolescents do not obtain enough sleep [1,2].

➢Several changes in lifestyle contribute to the lack of sleep during adolescence, such as school and work schedules, expanding extracurricular activities and social networks, alterations in parent-child relationships, and increased access to caffeine, drugs, and alcohol [3].

➢Adolescence is an optimal time to study the association between stress and sleep because of these changes in lifestyle and behavioral patterns. This study measured objective stress and objective sleep to examine their concurrent and longitudinal relationships.



Methods:

➢**Participants-** 82 adolescent were recruited during the spring semester of their senior year in high school. The final analytic sample for the first wave (spring semester in high school) consisted of 79 youth (24% male), and in the second wave (fall semester of college), a total of 76 adolescents (24% male) participated.

➢**Measures-** 3 consecutive, typical days of participation, with 5 saliva samples and corresponding diary entries per day.

➢Participants were asked to wear an Actigraph Score watch, a wrist-based accelerometer than quantifies movement. The Actigraph assessed two sleep parameters: sleep duration (SD) and sleep efficiency (SE).

➢The CAR (cortisol awakening response), AUC (area under the diurnal cortisol curve), and diurnal slope were calculated using a regression of log-transformed cortisol concentrations on sample collection time.

➢**Analyses-** Ordinary least squares regression analyses were conducted predicting each cortisol parameter from sleep duration and efficiency.

➢Two separate regression analyses were run to examine the concurrent (Model 1) and longitudinal (Model 2) associations between cortisol and sleep.

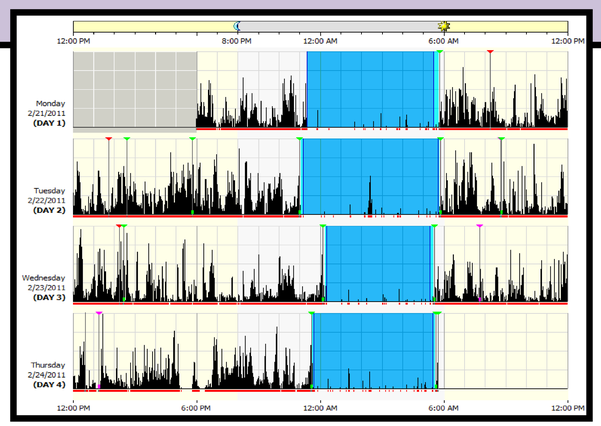


Table 3

Multiple Regression Analyses Predicting Diurnal Cortisol from Sleep Duration

	Cortisol Awakening Response		Area Under the Curve		Diurnal Slope	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Sleep Duration T2[a]	-0.123*	-0.147*	-4.531**	-3.991*	-0.016*	-0.015*
Sleep Duration T1[a]		0.057		-1.611		-0.004
Sex (Male =1)	-0.163	-0.085	0.965	0.234	-0.006	0.008
Caucasian Ethnicity	0.058	0.132	-1.445	-2.115	-0.015	-0.014
Caffeine Use	-0.177	-0.243*	3.081	3.411	0.001	0.000
Nicotine Use	0.153	0.211	-5.705	-5.713	0.032	0.031
Oral Contraceptive Use	-0.277*	-0.243	4.408	4.459	0.024	0.024
Constant	.698**	.667**	72.397**	72.680**	-0.111**	-.111**

Note. $^{*}p<.05$, $^{**}p<.01$. [a] measured in minutes reflecting total actigraph detected sleep time. All sleep parameters were standardized.

Results:

➢Cross sectional models revealed that sleep duration was associated with a smaller CAR (ß=-0.123, p<.05), lower AUC (ß=-4.531, p<.01), and a steeper cortisol slope (ß=-0.016, p<.05)

➢Longitudinal analyses indicated that it was concurrent sleep duration rather than the change in sleep duration that was associated with the cortisol parameters.

➢Neither sleep efficiency , sex, race, caffeine, nicotine, nor oral contraceptive use were significantly associated with any cortisol parameters.

Discussion:

➢ This study took an important first step in understanding the association between sleep patterns and diurnal cortisol rhythms as adolescents transition to college.

➢ The results revealed that sleep duration was concurrently associated with diurnal cortisol rhythms: longer sleep duration yielded a smaller CAR, a lower AUC, and a steeper cortisol slope. However, this relationship was not present longitudinally.

➢ Overall, these findings suggest that current sleep behavior and diurnal cortisol rhythms are associated during the first semester of college and may be important indicators of every day physiological stress activity and regulation of healthy behavioral patterns across the transition to college.

References:

1. Dahl, R.E., & Lewin, D.S. (2002). Pathways to adolescent health: Sleep regulation and behavior. Journal of Adolescent Health, 31, 175-184.
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3. Capaldi, V.F., Handwerger, K., Richardson, E., & Stroud, L.R. (2005). Associations between sleep and cortisol responses to stress in children and adolescents. Behavioral Sleep Medicine, 3, 177-192.