MIND, BRAIN, AND EDUCATION

School Characteristics, Child Work, and Other Daily Activities as Sleep Deficit Predictors in Adolescents from Households with Unsatisfied Basic Needs

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ABSTRACT— Sleep in adolescents has been shown to be an important factor when looking at physical, mental, and social well-being. Little evidence is found regarding sleep patterns in adolescents from households facing extreme poverty, where conditions such as crowding, poor housing, sanitation or education, and precarious employment set an adverse environment for sleep. In this study, we sought to assess in a nationwide sample comprised of 1,682 adolescents from Argentina, how the presence of extreme poverty—as defined by the presence of unsatisfied basic needs (UBN)—affects the relationship of sleep duration with school, work, and other daily activities. A global high prevalence of short sleeping time, a slight increase of sleep time in adolescents with UBN, and different patterns of wake activities that predict sleep deficit, depending on the presence of UBN, were found. The poor academic achievement, increased risk of accidents, and adverse health outcomes associated with sleep deprivation support the view that sleep is an additional unsatisfied basic need that worsens living conditions at this age. The results may help to design public health policies that contribute to ameliorate this adverse situation.

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Sleep in adolescents has been shown to be an important factor when looking at physical, mental, and social well-being. Adolescents with short sleep duration are at an increased risk of accidental injuries (Carskadon, Acebo, & Jenni, 2004). Reduced sleep is considered a risk factor for overweight and obesity, as well as for type 2 diabetes and cardiovascular disease (Cappuccio et al., 2008; Perez-Chada, Drake, Perez-Lloret, Videla, & Cardinali, 2009). A number of studies have demonstrated that sleep of insufficient duration or quality is associated with different negative mental health outcomes that include anxiety, depression, and bipolar disorders (Mindell & Meltzer, 2008). Youths who experienced sleep problems had greater odds of interpersonal dysfunction (Roberts, Roberts, & Chen, 2001). Also, late bed and rise times, erratic sleep–wake schedules, shortened total sleep time, and poor sleep quality are negatively associated with academic performance (Perez-Chada et al., 2007; Perez-Lloret et al., 2013; Wolfson & Carskadon, 2003).

Several factors affect sleep in this age group. Developmental changes due to intrinsic regulatory mechanisms in the homeostatic and circadian sleep processes delay the timing of sleep. Such psychosocial issues as self-selected bed times, academic pressure, the use of technological resources, and social networking in the evening also delay bed time. On the other hand, social pressures determine an early rise time for starting school day timely. Therefore, adolescents are asked to be awake at an inadequate circadian phase and sleep too little (Carskadon, 2011).

In addition, it was observed that a "sleep disparity" exists in the general population as poor sleep is strongly associated with poverty and race. A differential vulnerability to factors such as health, education, and employment was suggested as mediator for this effect (Cardinali et al., 2013; Patel, Grandner, Xie, Branas, & Gooneratne, 2010). Adolescents from lower socioeconomic households have poorer and less consistent sleep than those from more favored backgrounds; neighborhood and home conditions are the aspects associated with these observations (Marco, Wolfson, Sparling, & Azuaje, 2011). This is aggravated by the fact that in poorer households child work is much more common, which tends to increase the risk for sleep problems as adolescents are involved in dual duties that further limit their time for sleep (Fischer, Nagai, & Teixeira, 2008; Teixeira, Fischer, & Lowden, 2006; Vinha, Cavalcante, & Andrade, 2010). According to the International Labour Organization (ILO), around 168 million children aged 5–17 years worldwide are engaged in child labor, accounting for almost 11% of the child population as a whole (International Labour Office—International Programme on the Elimination of Child Labour (IPEC), 2013). In Argentina, approximately 20% of teens between 13 and 17 years were involved in economic activities and 14% were involved in intensive domestic work in 2012 (Tuñón, 2013).

In this context, less evidence was found regarding sleep problems in adolescents from households facing extreme poverty conditions, where conditions such as crowding, poor housing, sanitation or educational level, and a precarious employment set an adverse environment for sleep. For instance, slum dwellers report bad indexes of sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbances and daytime dysfunction, that improve after minimal changes in the quality of basic housing. Understanding sleep patterns in this population could help to define interventions to reduce sleep disparity (Simonelli et al., 2013). Therefore, we sought to assess, in a nationwide sample, how the presence of extreme poverty—as defined by the presence of unsatisfied basic needs (UBN)—affects the already known relationship of sleep duration with school and working schedules, controlling for the practice of other daily activities.

METHODS

Subjects and Design

The analysis uses data from the 2012 Argentine Social Debt Barometer (Barómetro de la Deuda Social Argentina), Pontificia Universidad Católica Argentina, a nationwide urban probability sample of adults residing in Argentina aged 18 years and over. Participants were selected by multistage cluster random sampling based on urban agglomeration, housing conditions, and socioeconomic status. In the first stage, demographic criteria (by geographic region and size) were used to select 20 urban agglomerations of 80,000 inhabitants or more. Second, stratified random sampling was used in conjunction with a variable-radius plot, with probability proportional to the size of the 18-year-old and older population. At the third stage, random systematic sampling was used to select each house inside the radius plot. A trained interviewer visited the houses, and individuals invited to participate on each house were randomly selected through a quota system of age and sex. Finally, 5,636 individuals (46.4% males and 53.6% females) gave oral informed consent and participated in the survey. The information regarding the teenagers that lived in the house was gathered only when the respondent was a parent or legal guardian. For the analysis, the cases were weighted to reflect each subgroup's actual proportion in the population.

Measures

Demographics

The UBN index was used as an indicator of extreme poverty. The presence of UBN was defined when children or adolescents lived in a household that presented at least one of the following: (a) more than three people per room (crowding); (b) house built with irregular materials or living in a rented room (housing); (c) not having an indoor flush toilet (sanitation); (d) having a child between 6 and 12 years old who is not attending school (school attendance); and (e) households with four or more people per employed person and the maximum educational level of the household head being elementary. The sample was divided by the presence of UBN. Numerical age and percentage of female gender were reported.

Sleep

Questions regarding sleep included bed time (lights off), rise time, and total amount of sleep during the day (nap duration). The variables derived from these questions were night sleep (rise time–bed time), nap habit (nap duration > 0), total sleep time (TST = night sleep + nap duration), and sleep deficit (TST < 9 hr for adolescents).

School

Questions regarding school characteristics included school starting time (morning, afternoon, or evening), school distance (in city blocks), and school day length (simple or double shift). School distance > 1 km was derived from the variable school distance.

Child Labor

The propensity of being engaged in intensive domestic work ("home work") was defined when the adolescent usually has the responsibility of: (a) house attendance (clean and dust, wash and iron, etc.); (b) cooking; (c) taking care of siblings; or (d) undertaking shopping, running errands, or fetching wood or water. The propensity of being engaged in economical activities ("paid work") was considered when the child or adolescent helped his/her parents in their job, did an activity by him/herself for earning money, or had a job as an employee or trainee, within the last 12 months.

Other Activities

Activities that may interfere with sleep were also reported, including: (a) the daily use of screens (TV, computers, and play station) for more than 2 hr ("screen > 2 hr"); (b) daily outdoor playing (biking, skating, running, climbing, football, etc.) for more than 2 hr ("outdoor > 2 hr"); (c) nonscholar intellectual activities (music, painting, dance, foreign languages, chess, computer courses, scholar support courses, etc.) within the last 30 days ("extracurricular intellectual activities"); and (d) nonscholar sport or physical activities (football, basketball, biking, swimming, skating, etc.) within the last 30 days ("extracurricular physical activities").

Statistical Analyses

Numerical variables were reported as mean ± standard error and categorical variables were reported as frequency (percentage). Differences between adolescents with or without UBN and between adolescents with our without sleep deficit

Table 1
Unsatisfied Basic Needs and Sleep Deficit

	Unsatisfied Basic Needs								
	No (n = 1,292, 77%) Sleep deficit			*Yes (n = 390, 23%) Sleep deficit*			*Total (n = 1,682, 100%) Sleep deficit*		
	No (n = 700, 61%)	*Yes (n = 454, 39%)*	*Total (n = 1,154, 100%)*	*No (n = 257, 67%)*	*Yes (n = 125, 33%)*	*Total (n = 382, 100%)*	*No (n = 957, 62%)*	*Yes (n = 579, 38%)*	*Total (n = 1,536, 100%)*
Demographics									
Female	333 (48%)	225 (50%)	558 (48%)	124 (48%)	65 (52%)	189 (49%)	457 (48%)	290 (50%)	747 (49%)
Age (years)	14.9 ± .05	15.0 ± .06	15.0 ± .04	15.0 ± .08	14.9 ± .11	15.0 ± .07	15.0 ± .04	15.0 ± .06	15.0 ± .03
Sleep									
Bed time (hr)	22.8 ± .05	23.4 ± .04	23.1 ± .03	22.7 ± .07	23.4 ± .07	22.9 ± .06	22.8 ± .04	23.4 ± .04	23.0 ± .03
Rise time (hr)	8.6 ± .06	6.8 ± .03	7.9 ± .05	8.9 ± .10	6.8 ± .04	8.2 ± .08	8.7 ± .05	6.8 ± .03	8.0 ± .04
Night sleep (hr)	9.8 ± .05	7.4 ± .04	8.8 ± .05	10.2 ± .09	7.4 ± .06	9.3 ± .09	9.9 ± .04	7.4 ± .03	8.9 ± .04
Nap habit	164 (23%)	66 (14%)	229 (20%)	54 (21%)	13 (10%)	66 (17%)	218 (23%)	78 (14%)	296 (19%)
Nap duration (hr)	1.8 ± .06	1.4 ± .07	1.7 ± .05	2.0 ± .12	1.3 ± .13	1.9 ± .10	1.9 ± .06	1.3 ± .06	1.7 ± .05
Total sleep time (hr)	10.2 ± .05	7.6 ± .04	9.2 ± .05	10.6 ± .09	7.6 ± .06	9.6 ± .10	10.3 ± .04	7.6 ± .03	9.3 ± .04
School									
Distance > 1 km	229 (37%)	220 (52%)	449 (43%)	57 (27%)	36 (30%)	93 (28%)	285 (34%)	256 (47%)	541 (39%)
Morning	302 (48%)	315 (71%)	617 (58%)	91 (43%)	96 (81%)	187 (57%)	393 (47%)	411 (73%)	804 (57%)
Afternoon	280 (45%)	40 (9%)	320 (30%)	106 (50%)	9 (8%)	116 (35%)	386 (46%)	49 (9%)	436 (31%)
Evening	9 (1%)	6 (1%)	15 (1%)	5 (2%)	0 (0%)	5 (2%)	14 (2%)	6 (1%)	20 (1%)
Full day	37 (6%)	80 (18%)	117 (11%)	10 (5%)	14 (11%)	24 (7%)	47 (6%)	93 (17%)	140 (10%)
Child labor									
Home work	70 (10%)	33 (7%)	103 (9%)	62 (24%)	35 (28%)	97 (25%)	132 (14%)	69 (12%)	201 (13%)
Paid work	104 (15%)	76 (17%)	180 (16%)	64 (25%)	33 (26%)	97 (25%)	168 (18%)	109 (19%)	277 (18%)
Other activities									
Screen > 2 hr	473 (68%)	316 (70%)	789 (68%)	141 (55%)	88 (70%)	229 (60%)	614 (64%)	404 (70%)	1019 (66%)
Outdoor > 2 hr	206 (33%)	133 (32%)	339 (33%)	86 (40%)	49 (42%)	135 (40%)	291 (35%)	183 (34%)	474 (35%)
Extracurricular intellectual	186 (27%)	173 (38%)	359 (31%)	41 (16%)	29 (23%)	70 (18%)	227 (24%)	202 (35%)	429 (28%)
Extracurricular physical	308 (44%)	250 (55%)	558 (48%)	101 (39%)	46 (37%)	147 (38%)	409 (43%)	296 (51%)	705 (46%)

Note. Values are expressed as mean ± standard error for numerical variables or frequency (percentage) for categorical variables.

were assessed through independent *t*-tests (numerical variables) or chi-square tests (categorical variables). A binary logistic regression model was conducted to determine independent predictors of sleep deficit in subjects with or without UBN, introducing independent factors by means of a stepwise forward conditional method.

RESULTS

The sample included 1,682 teenagers between 13 and 17 years old. Table 1 shows demographics, sleep duration, school characteristics, and other daily activities of the sample. The presence of sleep deficit was observed in 38% of the whole sample, with a mean bed time at 23.4 ± 0.04 hr and a mean rise time at 6.8 ± 0.03 hr, comprising a mean night sleep time of 8.4 ± 0.03 hr. Nap habit was present in 15.2% of these subjects, determining a mean total sleep time of 7.4 ± 0.03 hr. Most adolescents attended morning school. Evening students were very few, so they were excluded from further statistical analyses. The percentage of teens who were involved in work was 13% (home work) and 18% (paid work) Screen use > 2 hr was the activity that involved the highest percentage of the studied sample (Table 1).

A different pattern of sleep–wake characteristics associated with sleep deficit was observed depending on the presence of UBN (Table 1). UBN was significantly associated with a lower percentage of sleep deficit ($\chi^2 = 5.35$, $p = .021$), mild later rise time ($t = -3.40$, $p = .001$), increased night sleep ($t = -4.40$, $p < .001$), and total sleep time ($t = -4.11$, $p < .001$), lower percentage of adolescents that attend distant schools ($\chi^2 = 23.1$, $p < .001$), higher percentage of adolescents that work at home ($\chi^2 = 73.0$, $p < .001$) or outside home ($\chi^2 = 21.5$, $p < .001$), lower percentage of adolescents with screen use > 2 hr ($\chi^2 = 8.87$, $p = .003$), lower percentage of adolescents that engage in extracurricular intellectual ($\chi^2 = 30.8$, $p < .001$) or physical activities ($\chi^2 = 12.8$, $p < .001$) (Table 1, statistics not shown in the table).

Table 2 shows the univariate and multivariate predictors of sleep deficit in adolescents without and with UBN. In those without UBN, sleep deficit was independently predicted by school distance, school starting time, full-day school, and working outside home. In those with UBN, sleep deficit was independently predicted by school starting time, full-day school, screen use > 2 hr, and working at home, while being outdoor playing > 2 hr was a protective factor. In both conditions, morning school starting time highly augments the risk of sleep deficit (Table 2).

DISCUSSION

The main result of this study is the finding of a global high prevalence of short sleeping duration, a slight increase of sleep duration in adolescents with UBN, and different patterns of wake activities that predict sleep deficit, depending on the presence of UBN. The prevalence rate of reduced sleep

Table 2
Univariate and Multivariate Predictors of Sleep Deficit in Adolescents

	Unsatisfied Basic Needs = no				*Unsatisfied Basic Needs = yes*			
	Univariate[a]		*Multivariate*[b]		*Univariate*[a]		*Multivariate*[b]	
	T *or* χ^2	*p*	*OR (95% CI)*	*p*	T *or* χ^2	*p*	*OR (95% CI)*	*p*
Demographics								
Female	.41	.524	—	—	.52	.470	—	—
Age (years)	−1.28	.202	—	—	1.35	.179	—	—
School								
Distance > 1 km	23.9	<.001	1.77 (1.33–2.36)	<.001	.53	.467	—	—
Morning	133	<.001	8.35 (5.66–12.31)	< .001	59	<.001	14.45 (6.76–30.89)	<.001
Full day	134	<.001	14.0 (8.1–24.5)	<.001	37	<.001	18.39 (5.82–58.11)	<.001
Child labor								
Home work	2.5	.112	—	—	.67	.414	2.14 (1.14–4.03)	.019
Paid work	.77	.380	1.67 (1.10–2.55)	.017	.113	.737	—	—
Other activities								
Screen > 2 hr	.53	.47	—	—	8.45	.004	2.15 (1.23–3.76)	.007
Outdoor > 2 hr	.06	.806	—	—	.11	.736	.38 (.18–.80)	.011
Extracurricular intellectual	17.0	<.001	—	—	2.95	.086	—	—
Extracurricular physical	13.5	<.001	—	—	.28	.598	—	—

OR = Odds ratio; 95% CI = 95% confidence interval; TST = total sleep time.[a]Univariate analyses: *t*-test (numerical variables) or chi-square test (categorical variables).[b]Multivariate analyses: binary logistic regression. Model summary without UBN: 82.2% cases included, 68.9% cases predicted, $R^2 = 0.248$; with UBN: 80.6% cases included, 72.6% predicted. $R^2 = 0.345$.

of 38% identified in the population of this study is comparable to the one reported by our group in four cities from Argentina (49%) (Perez-Chada et al., 2007), and by other groups in Santa María (54%) (Pereira, Moreno, & Louzada, 2014) and São Paulo (39%) (Leite Bernardo, Felden Pereira, Mazzilli Louzada, & D'Almeida, 2009) from Brazil. These rates were obtained employing a cut point of 8 hr to define sleep deficit, but on the other side, day-time sleeping (naps) was excluded from the calculation.

The presence of UBN increased rise time and sleep duration. This contradicts previous literature, where a lower socioeconomic background is usually associated with less sleep duration and more sleep disruption in adolescents (Knutson & Lauderdale, 2009; Leite Bernardo et al., 2009). Socioeconomic demographics such as income, educational level, and employment status are usually associated with more delayed, shorter duration, and less consistent sleep patterns (Marco et al., 2011). However, none of these studies focused in situations of extreme poverty. Among the factors associated with the presence of UBN that may justify these findings, the assistance to nearby schools probably explain the delayed rise time and indirectly the increased sleep duration. The association between UBN and attendance at neighborhood schools is as expected, as the search for better schools tends to be available for families with higher socioeconomic status through residential mobility and enrolment in private schools (Musset, 2012). Another factor that could explain the delayed rise time is the observed lower percentage of children that engage in extracurricular intellectual or physical activities. However, if this had been the case, those activities would have been mostly developed in the morning, and differences in the percentage of school morning assistance should have also been observed.

School starting time and full-day schooling were strong predictors of sleep deficit in adolescents with and without UBN. Starting school in the morning is a well-recognized risk factor for sleep deprivation, determining less time spent in bed, worse sleep quality, and increased daytime sleepiness which in turn leads to bad mood and poor performance (De Souza, Cortez de Sousa, Leao Maia, & Macedo de Azevedo, 2011; Perez-Lloret et al., 2013; Wolfson & Carskadon, 1998). Unlike other school systems, in Argentina some schools have half-day schedules while others have full-day schedules. It is expected that the extended day poses a higher risk of sleep deficit, because it combines an early school starting with being at school most of the day (Alasker & Flammer, 1998; Kalenkoski, Ribar, & Stratton, 2009), thus preventing the possibility of taking naps and delaying bed time. As discussed below, this is more serious when adolescents are involved in some kind of work. In addition, in adolescents without UBN, school distance was a risk factor for sleep deficit, as reported previously by other authors. For example, in a sample of 1,126 adolescents in an urban area in Brazil, longer school commute was associated with an earlier rise time and delay at the midsleep phase, especially in adolescents who started school in the morning, which led to a significantly reduced time in bed (Pereira et al., 2014).

Child labor appeared as a predictor of sleep deficit. In adolescents without UBN, the risk is associated with paid work, while in adolescents with UBN it is associated with intensive work at home. Our results are consistent with those of previously published studies that show that working adolescents wake up earlier and have decreased night and total sleep duration during the week than nonworking students (Fischer et al., 2008; Teixeira et al., 2006; Vinha et al., 2010). Less information was found regarding the potentially sleep-damaging effects of work at home. In a cross-national research comprised of 2,315 adolescents from Europe and the United States, household work was negatively correlated with sleep and it was suggested that adolescents from poorer families were more involved in this kind of work (Alasker & Flammer, 1998). In this regard, maternal education correlates negatively with teens' time spent in housework, while teenagers in households with higher incomes spend more time in paid work (Wight, Price, Bianchi, & Hunt, 2009).

Finally, it is worth describing the impact of other activities on sleep deficit. In adolescents with UBN, sleep deficit was independently predicted by screen use > 2 hr, while outdoor playing > 2 hr was a protective factor. Watching TV or using computers was found to delay bed time, decrease sleep duration, and reduce subjective sleep quality (Knutson & Lauderdale, 2009; Mesquita & Reimao, 2007). Interestingly, TV use is increased in children from households with lower socioeconomic status (Stamatakis, Hillsdon, Mishra, Hamer, & Marmot, 2009) and computer use is increased in families with higher family incomes (Wight et al., 2009). Regarding the protective effect of playing outdoors, it could be understood as way of preventing excessive screen use and promoting sleep by several physiological mechanisms including sunlight exposure, thus representing a sleep hygiene measure (Buman & King, 2010).

Several limitations of this study must be taken into account. First, objective measures were not performed. Second, information about sleep schedules was provided by the parent or legal guardian, and not directly by the adolescent. Third, information about daily activities was gathered in the context of a social study not specifically aimed at assessing factors that predict sleep. Nevertheless, we think that the information provided by this work is still valuable and highlights the utility of using nationwide social surveys or census data to develop chronobiological studies.

To conclude, this study focused on the study of factors that may be involved in the sleep deprivation of adolescents with UBN. Household work appeared as a risk factor that may increase the burden of sleep deficit, while playing outdoors appeared as a protective factor, adding to

the well-recognized risk factors of starting school early and watching screens for long periods. The reduced academic achievement, increased risk of accidents, and adverse health outcomes associated with sleep deprivation pose sleep as an additional unsatisfied basic need that worsens living conditions of this group of teens. In this regard, our results may help to design public health policies that contribute to ameliorate this adverse situation.

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