The Short and Long of Adolescent Sleep: The Unique Impact of Day Length

Kate Bartel (hons)[a], Annette van Maanen (PhD)[b], Jamie Cassoff (PhD)[c], Oddgeir Friborg (PhD)[d], Anne Marie Meijer (PhD)[b], Frans Oort (PhD)[b], Paul Williamson (PhD)[a], Reut Gruber (PhD)[c], Bärbel Knäuper (PhD)[c], Michael Gradisar (PhD)[a]

[a]Flinders University, School of Psychology, GPO Box 2100, Adelaide, SA, AUSTRALIA, 5001
[b]University of Amsterdam, P.O. Box 15776, 1001 N**G,** Amsterdam, NETHERLANDS

[c]McGill University, 845 Sherbrooke Street West, Montreal, Quebec H3A 0G4, CANADA

[d]UiT The Arctic University of Norway, Faculty of Health Sciences, Department of Psychology, N-9037 Tromsø, NORWAY

Correspondence to:

Kate Bartel
School of Psychology
GPO Box 2100
Adelaide, SA 5001
AUSTRALIA
Email: kate.bartel@flinders.edu.au

Email addresses of authors:

KB,	kate.bartel@flinders.edu.au
AVM,	A.vanMaanen@uva.nl
JC,	jamie.cassoff@gmail.com
OF,	oddgeir.friborg@uit.no
AMM,	ammeijer25@gmail.com
FO,	F.J.Oort@uva.nl
PW,	paul.williamson@flinders.edu.au
RG,	reut.gruber@douglas.mcgill.ca
BK,	barbel.knauper@mcgill.ca
MG,	michael.gradsar@flinders.edu.au

SUMMARY

Study Objectives: Variation in day length is proposed to impact sleep, yet it is unknown whether this is above the influence of behavioural factors. Day length, sleep hygiene and parent-set bedtime were simultaneously explored, to investigate the relative importance of each on adolescents' sleep.

Methods: An online survey was distributed in 4 countries at varying latitudes/longitudes (Australia, The Netherlands, Canada, Norway).

Results: Overall, 711 (242 male; age M=15.7$\pm$1.6, range=12-19yrs) adolescents contributed data. Hierarchical regression analyses showed good sleep hygiene was associated with earlier bedtime, shorter sleep latency and longer sleep (ß=-.34;-.30;.32, p<.05, respectively). Shorter day length predicted later bedtime (ß=.11, p=.009), decreased sleep latency (ß=-.21, p<.001), and total sleep (ß=-.14, p=.001). Longer day length predicted earlier bedtimes (ß=-.11, p=.004) and longer sleep (ß=.10, p=.011).

Conclusions: Sleep hygiene had the most clinical relevance for improving sleep, thus should be considered when implementing adolescent sleep interventions, particularly as small negative effects of shorter day length may be minimised through sleep hygiene techniques.

Keywords:

Adolescent; day length; parent-set bedtime; sleep; sleep hygiene

Abbreviations[1]:

[1] ASHS-R = Adolescent Sleep Hygiene Scale – Revised, M = mean, SD = standard deviation, SE = standard error

INTRODUCTION

Adolescence is a time marked by relatively rapid physiological, biological and hormonal changes, all of which contribute to changing sleep patterns (Carskadon, 2011; Jenni & Carskadon, 2004; Roenneberg et al., 2004). As adolescents become older, their ability to postpone sleep onset increases, through a reduction in the escalation of sleep pressure, and a natural delay in their sleep timing (via a delayed 24-hr circadian rhythm timing; Carskadon, 2011). This, in conjunction with constraints imposed on sleep through starting school can lead to restricted sleep, especially on weekdays (Gradisar, Gardner, & Dohnt, 2011; Perkinson-Gloor, Lemola, & Grob, 2013). Healthy sleep is vital for adolescents' wellbeing (Roberts, Roberts, & Duong, 2009), affecting their mental health, interpersonal problems (Roberts et al., 2009) and school performance (Kronholm et al., 2015). It is thus important to consider the extent to which contributing factors beyond adolescents' behavioural control (i.e., age, gender, day length) influence their sleep, before examining factors within their control (i.e., sleep hygiene, parent-set bedtime, alcohol, tobacco) in order to empower adolescents, and their caregivers, with the knowledge and tools to achieve optimal sleep health.

In terms of demographics, younger *age* is predictive of longer sleep in adolescents, yet effects of *gender* decrease by mid-adolescents (Fredriksen, Rhodes, Reddy, & Way, 2004). *Sleep hygiene* is a factor under behavioural control, and comprises multiple facets that may benefit the sleep of adolescents, including consistent bedtime routines, avoidance of pre-bedtime stimulating substances (e.g., caffeine) and activities (e.g., technology use), or a comfortable sleep environment (e.g., quiet and dark bedroom; Bartel, Gradisar, & Williamson, 2015; Storfer-Isser, Lebourgeois, Harsh, Tompsett, & Redline, 2013). *Parent-set bedtimes* have recently been shown to be an important determinant of adolescents' sleep, being consistently linked with longer sleep durations (yet not sleep latency; Bartel et al., 2015), which in turn improve adolescents' daytime alertness and decreasing their fatigue (Short et al., 2011), depression and suicidal ideation (Gangwisch et al., 2010). However, the benefits of weekday parent-set bedtime on bedtime and total sleep do not occur when parents' limitations are temporarily removed (i.e., weekends (Short et al., 2011).

However, one understudied area are geographic factors, which may influence when adolescents retire for bed, how long it takes them to fall asleep, and how much sleep they obtain. Interestingly, small shifts in *longitude and latitude* are suggested to impact bedtime (Borisenkov, Perminova, & Kosova, 2010), with a trend towards a negative relationship with longitude (i.e., further East longitude and earlier bedtime), yet a positive relationship with latitude (i.e., further North latitude and later bedtime; Bartel et al., 2015). Trends in the association between longitude/latitude and adolescent sleep duration have not appeared (Masal et al., 2015), however, there is potential for broader ranges in longitude and latitude to allow for differences in sleep duration to be observed (i.e., Masal et al., 2015) measured adolescents at differences of 6^0E and 19^0N). Nevertheless, the number of studies into the associations between longitude and latitude with adolescents' sleep is extremely small (i.e., 4 studies to the authors' knowledge; Borisenkov et al., 2010; Masal et al., 2015; Randler, 2008a; Randler, 2008b), especially when compared to the plethora of studies investigating topical factors (e.g., technology use; 67 studies with 5-17 year old participants; Hale, & Guan, 2015). A recent meta-analysis showed the possibility of small relationships between latitude and longitude with adolescents' bedtimes, sleep latency, and total sleep time, yet unfortunately, these were based on only 2 studies, each with relatively small shifts in longitude and latitude (Bartel et al., 2015). Of note, changes in longitude and latitude result in variations in sunrise and sunset times, and hence day length. To increase our confidence that there does indeed exist a meaningful association between longitude and latitude (and therefore day length) with adolescents' sleep, more studies are needed. The aim of the present study was to assess the unique impact of day length on adolescents' bedtimes, sleep latency and total sleep time by sampling across multiple countries with large variations in latitudes (Australia, The Netherlands, Canada, Norway), whilst simultaneously controlling for important factors under behavioural control (i.e., sleep hygiene, parent-set bedtimes, demographics).

METHODS

Participants

A total of 1,554 adolescents commenced the survey from all 4 countries. Of these, 711 (242m) contributed data (see Table 1). Participants were aged 12-19 yrs (M = 15.7, SD = 1.6). This age range was chosen as sleep patterns start delaying in early teenage years, until the age of 20, and are suggested as the beginning and end of adolescent sleep patterns, respectively (Roenneberg et al., 2004). Age and gender demographics were similar for those who provided data compared to all adolescents who started the survey.

Materials

Survey completion date, and residence/postcode were used to determine sunrise and sunset times for individuals (online sunrise/ sunset calculator; http://www.sunrise-and-sunset.com/en/sun). Sunset and sunrise times were highly correlated (r= -.96, N = 711, p<.001), thus, to minimise collinearity, day length was calculated as follows: day length = sunset time in 24hr decimal clock time– sunrise time in decimal clock time.

Participants were asked to retrospectively report their typical weekday bedtime, sleep onset latency and total sleep time over the previous 2 weeks (e.g., *At what time do you usually go to bed to sleep at night?).* Norwegian sleep onset latency and total sleep time data were an exception, with weekday averages calculated from a 1-week sleep diary completed throughout the week. A high correlation between weekday sleep measured via sleep diaries and questionnaires have been previously reported (Arora, Broglia, Pushpakumar, Lodhi, & Taheri, 2013; Wolfson et al., 2003), therefore, although data collected in Norway was via a different method, Norwegian data remains comparable for analysis to that collected in the other 3 countries.

Sleep hygiene over the previous 2 weeks was measured via The Adolescent Sleep Hygiene Scale – Revised (ASHS-R; Storfer-Isser et al., 2013), which is a 24-item scale (6-point scale, *1* [*never*, *0%*] *–6* [*always*, *100%*]). Scores were reversed so that higher scores indicated better sleep hygiene. The ASHS-R has six subscales: physiological (5 items), behavioural arousal (3 items), cognitive/emotional (6 items), sleep environment (5 items), sleep stability (3 items) and daytime sleep (2 items). Each subscale score is the average of the items of which it comprises. The mean of each subscale score is summed (Storfer-Isser et al., 2013), and then divided by the number of subscales (i.e., 6) to obtain the total score. Thus, the total score is an average of the subscale ratings, ranging from 1-6, with higher scoring indicating better sleep hygiene. For the total sample, internal consistency for the 24 items was good (Cronbach's α = .83, *N* = 711). Internal consistency for the 24 items was also acceptable for each country (Cronbach's α = .83, *N* = 294, for Australian adolescents; Cronbach's α = .77, *N* = 138, for Dutch adolescents; Cronbach's α = .86, *N* = 146, for Canadian adolescents; Cronbach's α = .81, *N* = 133, for Norwegian adolescents). Respondents were asked whether they "*Smoked/chewed tobacco after 6pm"*, or "*drank alcohol after 6pm"*, using the same response scale.

Australian, Dutch and Canadian adolescents were asked "*My parents set my bedtime"* for weekdays (7-point response scale, *never –always*; recoded: *never/almost never* = 0*, sometimes-always* = 1). These data were recoded to match Norwegian data, where adolescents were asked whether their parents set their bedtimes on weekdays (*no/yes*). Finally, age and gender (*male*= 0, *female* = 1) were also collected.

Procedure

A 30-min, online survey, approved by the Social and Behavioural Research Ethics Committee, Flinders University, was conducted using Qualtrics (Qualtrics.com; Provo, Utah)[2]. A preliminary survey question asked for adolescents' consent to participate in the survey. Data collection in South

[2] Extra questionnaire data were collected for Australia, Canada and the Netherlands, and are accepted for publication elsewhere (Bartel, K., Williamson, P., van Maanen, A., Cassoff, J., Meijer, A. M., Oort, F., ... & Gradisar, M. (2016). Protective and risk Factors associated with adolescent sleep: Findings from Australia, Canada and The Netherlands. *Sleep Medicine,* 26, 97-103), yet the current paper focuses on day length, with higher variability in day length enabled due to collection of data among Norwegian adolescents for the data described in the current paper.

Australia occurred from October 2013 to May 2014, with the exception of school holidays which may alter adolescents sleep patterns (13/12/2013-9/02/2014; Bei et al., 2013; Warner, Murray, & Meyer, 2007). Upon completion, participants selected a charity, to donate AUD$1. Data were collected from the Netherlands (07/11/2013–21/05/2014; Faculty Ethics Review Board of the Faculty of Social and Behavioural Sciences, University of Amsterdam); Tromsø, Norway (13/01-19/01/2014; The Regional Committee of Medical and Health Research Ethics – Region North) and Canada (17/01-27/02/2014; 16/09/2014–23/02/2015; McGill University Research Ethics Board). Canadian participants were entered into a draw to win an iPad.

Statistical analysis

Outliers were identified as data with *z* scores outside $\pm$3.29 (Tabachnick & Fidell, 2007). Seven outliers were identified for bedtime, 2 for total sleep time and 1 for ASHS-R scores. Outliers were changed to one unit lower (for *z* scores below -3.29) or higher (for *z* scores above 3.29) than the next data point with an appropriate *z* score (Tabachnick & Fidell, 2007). Sleep onset latency was positively skewed; therefore corrected via logarithmic transformation (Tabachnick & Fidell, 2007). Other variables had normal or near normal distribution. Tobacco and alcohol use were both unevenly split, thus recoded (ASHS-R answers of *never*=0, responses 2-6=1).

Day length was non-normally distributed, thus dummy coded into three groups (short [range =0.5hr], mid [reference group; range = 7.58-13.00hr], long [range = 13.03-16.02hr]). It should be noted that due to all data collection taking place within the week following polar night (a time of 24hr darkness) in Norway, all adolescents in the short day length reference group were from Norway. The mid length group comprised 14.5% Australian, 50.3% Canadian and 35.2% Dutch adolescents. The long length group comprised 87.5% Australian and 12.5% Dutch adolescents.

Multiple hierarchical regression analyses assessed the contribution of the covariates on the dependent variables of bedtime, sleep onset latency and total sleep time. Only participants with complete data for individual sleep variables were used. Age and ASHS-R scores were centred for ease of interpretation. Age and gender were entered in step 1. Behavioural factors: sleep hygiene, parent-set bedtime, tobacco and alcohol, were entered at step 2, and day length was entered at step 3.

RESULTS

Bedtime

Variables at step 1 predicted 9.9% of the variance in bedtime, R^2=.099, F(2,705)=44.44, p<.001. Step 2 explained an additional 15.9% of variance, R^2*change* =.159, *Fchange* (4,701)=37.59, p<.001. Day length explained an additional 2.7% of variance in step 3, R^2*change* =.027, *Fchange* (2,699)=6.45, p<.001. Together, all variables explained 28.6% of variance of bedtime with good sleep hygiene habits having the largest association with earlier bedtimes. See Table 2 for regression coefficients.

Sleep onset latency

Variables at step 1 predicted 3.7% of the variance of sleep latency, R^2=.037, $F(2,696)=13.52$, $p<.001$. Variables in step 2 explained an additional 10.5% of variance, R^2*change* =.105, *Fchange* (4,692)=21.21, $p<.001$. Day length explained an additional 3.5% of variance, R^2*change* =.035, *Fchange* (2,690)=14.61, $p<.001$. Together, the variables predicted 17.7% of variance of sleep latency, with good sleep hygiene having the highest value association on shorter sleep onset latency (see Table 2 for regression coefficients).

Total sleep time

Variables at step 1 predicted 8.8% of the variance of total sleep time, R^2=.088, $F(2,682)=32.93$, $p<.001$. Variables in step 2 explained an additional 10.5% of variance, R^2*change*=.105, *Fchange* (4,678)=21.96, $p<.001$. Day length explained an additional 3.5% of variance, R^2*change*=.035, *F change* (2,676)=15.12, $p<.001$. Together, variables predicted 22.7% of variance of total sleep time. Good sleep hygiene predicted the most variance in total sleep time (see Table 2 for regression coefficients).

DISCUSSION

A shorter day length uniquely predicted later bedtimes, a shorter sleep onset latency and shorter total sleep time, whereas a longer day length predicted earlier bedtimes and longer sleep duration, in a significant, but small manner. Adolescents in Norway went to bed 18 min later and slept for 29 min less than adolescents in the mid-day length group. Furthermore, adolescents in the longer day length went to bed 15 min earlier and obtained 15 min more sleep than adolescents in the mid length group. This finding concurs with other studies, where shorter days for young adults have been associated with later sleep timing than longer days (Borisenkov, 2010; Friborg, Rosenvinge, Wynn, & Gradisar, 2014). We note though that adolescents in the present study may have been subjected to indoor- and screen-light, potentially delaying bedtimes and restricting sleep[3]. Adolescents living in areas with a shorter day length may be particularly vulnerable to the effects of evening light, as sensitivity to evening light has also been shown to increase for people who receive less light during the day (Chang, Scheer, & Czeisler, 2011; Wright et al., 2013; Zeitzer, Friedman, & Yesavage, 2011) and the period of adolescence maybe a time for increased sensitivity to evening light (Hagenauer, Perryman, Lee, & Carskadon, 2009). For instance, previous experiments freeing young adults of electronic media exposure (i.e., camping) have demonstrated earlier bedtimes and thus earlier sleep and circadian timing (Wright et al., 2013). Furthermore, a sample of Tromsø residents (including <10% of adolescents) studied over half a century ago (i.e., decades prior to the invention of technological devices yet with access to electrical lighting) went to bed earlier during shorter days compared to longer days (Kleitman & Kleitman, 1953). Therefore, it is possible that although adolescents in the short day length group experienced an earlier sunset time associated with shorter day length, that this lack of daylight exposure actually *increased* their sensitivity to evening artificial light, thus leading to later bedtimes. This hypothesis is further strengthened, as people who spend up to 2 hours outside each day are more likely to go to bed and rise earlier (Roenneburg & Merrow, 2007).Thus, future studies into day length would

[3] Of note, rerunning the sleep onset latency regression to control for bedtime and total sleep time in step 2 (results not presented) did not meaningfully alter the association with day length.

benefit from simultaneously measuring daylight, electrical lighting and screen-light.

Furthermore, a recent review of 87 datasets spanning 27 countries, in adult samples, suggested similar influences from the light-dark cycles on sleep patterns (Randler & Rahafar, 2017). The review assessed sunrise, sunset and photoperiod using the longest daylength of the year in the location each study. This contrasts the current study, which used the data collection date to ascertain photoperiod. Consequently, Randler and Rahafar (2017) concluded that later sunset time (i.e., higher latitude) was the strongest predictor of eveningness. Yet, as they used only location (not data collection dates) to determine sunset, these locations would likely also have the earliest sunset times on the shortest day of the year. As a later bedtime is a characteristic of eveningness, it can be seen that our results are in support of these findings, whereby adolescents at a higher latitude, and shorter daylength (i.e., Norway), went to bed later. Of note, sunset and photoperiod were nearly perfectly correlated in our study. Our study also supports and extends findings that Turkish adolescents (i.e., lower latitude) are more morning oriented than German adolescents (Horzum et al., 2015). Together, these results increase support for the ‘environmental hypothesis’ among adolescents, that is, that the light-dark cycle (and temperature) influence sleep patterns, with higher latitudes in particular predisposing people towards evening preference (Horzum et al., 2015; Randler & Rahafar, 2017).

In terms of demographic influences on sleep, gender had minimal impact, with females going to bed slightly later than males, after taking into consideration all other variables. For each year of increased age, adolescents’ bedtimes delayed 10 min, and total sleep decreased 12 min, with previous research finding similar trends across cultures (Gradisar et al., 2011; Olds, Blunden, Petkov, & Forchino, 2010). Effects of age on sleep onset latency were no longer present after accounting for other factors. Behavioural factors accounted for more variance than demographic factors, giving rise to the potential for effective behavioural interventions.

Good sleep hygiene had the largest, positive influence on sleep. For each 1-point increase on the sleep hygiene scale, bedtimes became 40 min earlier, and sleep was extended 41 min. Considering that an increase in total sleep by 20 min can improve performance on some cognitive tasks (Dewald-Kaufmann, Oort, & Meijer, 2013), this suggests our findings have clinical and academic relevance. Given sleep hygiene practises are under behavioural control, these should be encouraged among adolescents, including offering ways to relax before bedtime (e.g., mindfulness), and avoiding evening stimulation, such as caffeine (Bartel et al., 2015). Programs promoting sleep hygiene awareness and practice are promising (de Sousa, Araujo, de Azevedo, 2007) and may be a more effective method of improving adolescents' sleep en masse. Moreover, considering adolescents who had parent-set bedtimes went to bed 20 min earlier, and obtained 15 min more sleep, educating parents to consistently regulate adolescents' bedtimes may be a feasible approach (Gangwisch et al., 2010; Short et al., 2011) to improving adolescents' sleep. Thus, a consistent approach between schools, adolescents and their parents has the potential to enhance adolescent sleep health beyond the effects of day length.

Limitations

We note that reports on sleep were subjective, thus introducing some degree of recall bias. However, use of objective measures of sleep (i.e., wrist actigraphy; Wolfson et al., 2003) were not feasible on this scale. We also note the small sample size, and that we did not assess invariance for questionnaire measures. Determining whether is higher between or within countries would also be of value, and could be accomplished via multilevel modelling. Increasing the number of participating countries of differing latitudes/longitudes may increase the sensitivity of the day length variable, as well as allowing for more sensitive assessment of the role of cultural influences, a potential confound in the present study. For example, the timing of photoperiod can impact social rhythms (Jankowski, Vollmer, Linke, & Randler, 2014), therefore it is possible that day length may impact the timing of meals, and other social activities, on a population level in Norway differently from other countries, which in turn may influence adolescents' bedtime, sleep latency and sleep duration. Previous research, however, has demonstrated that the daylight is stronger regulator of the circadian rhythm than the social clock (Borisenkov et al., 2016; Roenneburg & Merrow, 2007). Furthermore, in a study conducted during Winter, among Russians living in northern latitudes (thus short daylight hours), increases in latitude were related to later bedtimes (Borisenkov, 2010). Thus, these studies (Borisenkov, 2010; Borisenkov et al., 2016; Roenneburg & Merrow, 2007) decrease the chance that our results could be explained by culture alone. Yet, our study adds to previous findings, as it expands the results of later bedtimes at shorter daylight hours to multiple continents. School start time can also influence sleep (Owens, Belon, & Moss, 2010). Norwegian adolescents commenced school at 8.30am, and majority of adolescents across Australian, Canadian and Dutch samples in the present study reported starting school between 8-9am.Thus although not analysed, confidence in the results relating to day length, and not school timing, is increased. There are further potential cultural differences between countries which were not measured, and should be considered. For example, a higher percentage of adolescents have been reported to spend 4 or more nights per week with peers in The Netherlands, Canada and Norway, respectively (World Health Organization [WHO], 2012). Despite this difference in patterns of socialising, time spent with peers has not been found to be associated with adolescent sleep (Bartel et al., 2015). As another example, higher levels of stress, including those felt at school, relate to more sleep problems (Wiklund, Malmgren-Olsson, Öhman, Bergström, & Fjellman-Wiklund, 2012). The prevalence of adolescents experiencing schoolwork pressure is higher in Canadian and Norwegian adolescents than among Dutch adolescents (Currie et al., 2012). Considering 50 percent of the mid length group comprised Canadian adolescents, this cultural factor fails to explain why Norwegian adolescents (short day length group), who share a similar prevalence of perceived schoolwork pressure to Canadian adolescents, would have later bedtimes, shorter sleep latency, and less sleep compared to the mid length group. Furthermore, although variation in patterns between countries of alcohol consumption depend on age and gender (Currie et al., 2012), age, gender and alcohol consumption were controlled in the present study, as was tobacco use.

Although these cultural differences should be considered when assessing the impact of day length on sleep parameters, there is insufficient evidence to suggest they outweigh the impact of day length on adolescent sleep. This is particularly true as parent-set bedtimes and good sleep hygiene, which were measured in the present study, should theoretically mediate any associations between evenings spent with peers and adolescent sleep, and the fact that alcohol and tobacco use were accounted for in the present study. Increasing participating countries would also allow for investigation of the influence of individual or other differences in sleep (van Dongen, Rogers, & Dinges, 2003).

Conclusion

Despite these caveats, our data suggest that adolescents living during times of reduced day length are not overly disadvantaged, despite shorter day length predicting later weekday bedtimes and less sleep. Compensation for any detrimental effects of shorter day length on adolescent sleep may occur, especially if parents employ weekday bedtimes, and adolescents can practice healthy sleep habits themselves, or as part of a school-based sleep program (Bei et al., 2013; Bonnar et al., 2015; Cassoff, Knäuper, Michaelsen, & Gruber, 2013).

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Table 1

Impact of day length on sleep: Descriptive statistics and frequencies.

Variable	*N*	*M*	*SD*	*Range*
Australia	294	-	-	-
The Netherlands	138	-	-	-
Canada	146	-	-	-
Norway	133	-	-	-
Age (years)	711	15.71	1.61	12-19
Weekday bedtime (decimal)	708	22.87	1.16	19.98-26.52
Weekday sleep onset latency (mins)[b]	699	40.87	38.37	0.00-270.00
Weekday total sleep time (mins)	685	442.19	76.67	197-690
ASHS-R	711	4.33	0.60	2.36-5.66
Short day length (hours, decimal)	133	0.50	0.0[a]	0.50
Mid length (hours, decimal)	290	9.93	1.47	7.58-13.00
Long day length (hours, decimal)	288	13.75	0.66	13.03-16.02
	N	*Yes*	*No*	
Parent-set bedtime	711	293	418	
Tobacco (after 6pm)	711	73	638	
Alcohol (after 6pm)	711	184	527	

Note. ASHS-r = Adolescent Sleep Hygiene Scale – Revised, M = mean, SD = standard deviation, [a] All participants in the short day length group were from Norway, and completed the questionnaire in the same time period, hence 0 variation in day length, [b] results for untransformed SOL variable.

Table 2

Multiple hierarchical regression analysis for variables predicting weekday bedtime (N=708), sleep onset latency (N = 699) and total sleep time (N = 685)

		Bedtime			*Sleep Onset Latency*			*Total Sleep Time*		
Model	Factors	*b*	*SE*	*Beta(p)*	*b*[b]	*SE*	*Beta(p)*	*b*	*SE*	*Beta(p)*
1	(Constant)	22.86	<.001	(<.001)	1.403	.025	(<.001)	451.515	4.757	(<.001)
	Age*	.223	<.001	.315(<.001)	-.041	.009	-.170 (<.001)	-13.326	1.697	-0.296(<.001)
	Gender[a]	.009	<.001	.004(.919)	.077	.031	.094 (.012)	-14.658	5.875	-0.079 (.013)
2	(Constant)	23.044	.080	(<.001)	1.435	.030	(<.001)	433.580	5.678	(<.001)
	Age*	.167	.027	.236(<.001)	-.021	.010	-.088 (.032)	-12.667	1.881	-.268(<.001)
	Gender[a]	-.144	.080	-.060(.071)	.027	.030	.033 (.355)	-3.878	5.683	-.024(.495)
	Sleep Hygiene*	.567	.064	-.300(<.001)	-.215	.024	-.331(<.001)	35.281	4.526	.279(<.001)
	Parent-set bedtime	-.392	.083	.083(<.001)	.060	.031	.076(.052)	19.419	5.920	.126(.001)
	Tobacco	.590	.130	.157(<.001)	-.040	.049	-.031(.410)	-22.868	9.371	-.090(.015)
	Alcohol	.071	.093	.027(.443)	-.055	.034	-.061(.111)	19.317	6.597	.110(.004)
3	(Constant)	23.129	.098	(<.001)	1.467	.036	(<.001)	429.422	6.932	(<.001)
	Age	.166	.027	.235(<.001)	-.012	.010	-.051 (.217)	-12.262	1.922	-.259(<.001)

Gender[a]	-.213	.080	-.089(.008)	.038	.030	.046(.202)	0.906	5.714	.006(.874)
Sleep Hygiene*	-.633	.064	-.335(<.001)	-.191	.024	-.295(<.001)	40.652	4.541	.321(<.001)
Parent-set bedtime	-.334	.083	-.145(<.001)	.032	.031	.040(.307)	14.804	5.885	.096(.012)
Tobacco	.450	.134	.120(.001)	.035	.050	.027(.482)	-10.929	9.579	-.043(.254)
Alcohol	.042	.091	.016(.644)	-.047	.034	-.052(.166)	20.802	6.471	.119(.001)
Day length (short)*	.307	.117	.106(.009)	-.212	.044	- .209(<.001)	-28.587	8.475	-.142(.001)
Day length (long)	-.247	.085	-.107(.004)	-.005	.032	.006(.879)	15.392	6.017	.099(.011)

Note. b = unstandardized regression coefficients, SE = standard error, [a]male= 0, female = 1, [b] = sleep onset latency was transformed, therefore unstandarsied regression coefficients do not represent an interpretable minute value, *indicates significance for all sleep variables at *p*<.05.