Running head: IRREGULAR SLEEP, INTERPARENTAL CONFLICT, AND ADOLESCENTS' AGGRESSION

Interparental Conflict and Early Adolescents' Aggression: Is Irregular Sleep a Vulnerability Factor?

Sakari Lemola, Beate Schwarz, and Andrea Siffert

[a] University of Basel, Department of Psychology

Missionsstrasse 62a, 4055 Basel, Switzerland

sakari.lemola@unibas.ch

beate.schwarz@unibas.ch

andrea.siffert@unibas.ch

Author Note

Address correspondence to:

Sakari Lemola, Department of Psychology, University of Basel,

Missionsstrasse 62a, 4055 Basel, Switzerland.

Tel.: +41 61 267 0638

Fax.: +41 61 267 0661

E-mail: sakari.lemola@unibas.ch

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Abstract

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We investigated whether (a) short and irregular sleep are related to aggressive behavior in early adolescence and (b) whether they moderate the relation between interparental conflict and aggressive behavior. 176 early adolescents (mean age 11.6 years, 89 girls) reported their bed and wake times on weekdays and on weekends and their aggressive behavior. Interparental conflict was rated by their mothers and adolescents reported whether they felt threatened by the conflict. No direct association between early adolescents' sleep and aggression was found. However, short sleep duration on weekday nights, long sleep duration on weekends, and a large weekday to weekend difference in sleep duration moderated the relation between interparental conflict and early adolescents' aggression. Findings are consistent with the hypothesis that irregular sleep is a vulnerability factor for early adolescents' aggression and underscore the importance of sufficient and regular sleep for resilience.

Keywords: Sleep Duration; Sleep Pattern; Aggressive Behavior; Interparental Conflict; Early Adolescence

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Across adolescence, important changes in sleep patterns occur. Sleep duration on weekdays shortens from around 10 hours among 10-year-olds to between 6.5 and 8.5 hours among older adolescents and bedtimes shift to a later time (Iglowstein, Jenni, Molinari, & Largo, 2003; Laberge et al., 2001). As school starts as early as for children, many adolescents build up a sleep debt during the school week and tend to sleep longer on weekend mornings to catch up on their sleep (Laberge et al., 2001). A nationally representative study showed that nearly half of the high school students in the United States get insufficient amounts of sleep on school nights (Carskadon, Mindell, & Drake, 2006). Moreover, symptoms of insomnia and daytime sleepiness are frequent (Ohayon, Roberts, Zulley, Smirne, & Priest, 2000). As insufficient sleep, insomnia, and prolonged activities at night are associated with negative physical and mental health consequences during childhood and adolescence (Aronen, Paavonen, Fjallberg, Soininen, & Torronen, 2000; Cappuccio et al., 2008; Cohen-Zion & Ancoli-Israel, 2004; El-Sheikh, Buckhalt, Cummings, & Keller, 2007; Lemola et al., 2011a; Paavonen et al., 2009) healthy sleep in adolescence has to be considered as an important public health concern.

A number of recent studies showed that *sleep deprivation* in childhood and adolescence is also related to increased aggression (Jenni & Dahl, 2007). Aggressive behavior was more frequent among children and young adolescents with disturbed sleep quality in a clinical study (Chervin, Dillon, Archbold, & Ruzicka, 2003). Short sleep also associated with higher levels of impulsive behavior in a population sample of 8-year old children (Paavonen et al., 2009). Moreover, surgical treatment of sleep disordered breathing has been shown to lead to a decrease of behavioral problems and aggression in children (Ali, Pitson, & Stradling, 1996; Chervin et al., 2006). As surgical treatment of sleep disordered breathing would not be expected to affect behavior in a manner independent of sleep, these findings suggest a causal

role of sleep for daytime functioning (for a discussion see Beebe, in press). In a similar vein, behavioral sleep treatment with substance abusing adolescents showed a decrease in aggressive thoughts and self-reported aggressive actions when sleep duration could be increased (Haynes et al., 2006). However, little is known whether sleep deprivation is also a risk for adolescents' aggression in general population samples.

Growing evidence suggests that also *irregularity of sleep*, usually measured as the weekday-to-weekend difference in sleep duration, might lead to behavioral dysregulation in children and adolescents. For example, irregular sleep can lead to jet lag-like symptoms such as daytime sleepiness, fatigue, difficulty falling asleep at night, and difficulty awakening in the morning (Dahl & Lewin, 2002). Further, irregular sleep relates to poor school performance (for a review see Wolfson & Carskadon, 2003), problems with concentrating (Brand, Hatzinger, Beck, & Holsboer-Trachsler, 2009), and contributes to behavioral problems (Bates, Viken, Alexander, Beyers, & Stockton, 2002; Pesonen et al., 2009; for inconsistent findings, see Moore et al., 2009).

One possible causal mechanism by which sleep patterns are linked with negative outcomes is that insufficient or irregular sleep can lead to deterioration of stress resistance. First, this has been shown with respect to the physiological stress reaction. Sleep deprivation or restriction among adults leads to a dysregulation of the hypothalamic-pituitary-adrenocortical (HPA) axis, which involves an increase in cortisol secretion (Buckley & Schatzberg, 2005; Leproult, Copinschi, Buxton, & van Cauter, 1997; Omisade, Buxton, & Rusak, 2010; Spiegel, Leproult, & Van Cauter, 1999). In turn, increased cortisol secretion at night was also associated with poorer sleep (Buckley & Schatzberg, 2005) suggesting a bi-directional relationship between HPA-axis and sleep regulation. This relationship has been claimed to exist already during childhood. Disrupted sleep as measured with actigraph

correlated with increased afternoon cortisol levels in children (El-Sheikh, Buckhalt, Granger, & Keller, 2008).

A second possible causal mechanism that may link insufficient or irregular sleep with negative outcomes is disturbed coping efficacy. Sleep deprivation leads to higher impulsivity, less self-regulation (Kahn-Green, Lipizzi, Conrad, Kamimori, & Killgore, 2006), it impedes adaptive coping with stress (Killgore et al., 2008), and lowers optimism (Haack & Mullington, 2005; Lemola et al., 2011b).

Hence, insufficient and irregular sleep may increase the vulnerability of the adolescents for psychosocial stressors as the vulnerability-stress perspective suggests (e.g., Seiffge-Krenke, 2000; Walker, Downey, & Bergman, 1989). Therefore, we expected that adolescents' ability to cope with psychosocial stressors is reduced when they sleep too little or have irregular sleep times. In the present study we focus on interparental conflict as a psychosocial stressor as numerous studies and metaanalyses have shown a relation between interparental conflict and children's and adolescents' aggressive behavior (Buehler et al, 1997; Buehler et al., 1998; Reid & Crisafulli, 1990). One explanation for the negative impact of interparental conflict on children's adjustment is given by the cognitive-contextual approach (Grych & Fincham, 1990; McDonald & Grych, 2006).

The cognitive-contextual framework (Grych & Fincham, 1990) points to the importance of children's perspective on and appraisals of the conflict when investigating the effects of interparental conflict. According to this theoretical approach, these conflicts are a heavy burden for children and adolescents when they perceive it as frequent, intense, and poorly resolved. The association between perception of interparental conflict and children's maladjustment is mediated by the children's appraisals and interpretations of the conflict. In a first step, they evaluate the negativity of the conflict and their feelings of threat imposed by the conflict. In a second step, they collect more information to understand the reasons of the

conflict, for instance, whether they are responsible for the conflict and whether they can cope with the situation. Further factors like gender or the current emotional state of the children can affect the strength of the association (Grych & Fincham, 1990). A lot of studies have supported this theoretical model (e.g., Grych, Harold, & Miles, 2003; Shelton & Harold, 2008, Siffert & Schwarz, 2011).

Other authors underline that conflict characteristics and the conflict tactics which parents use can be relevant for adolescents' adjustment. Interparental conflict which is characterized by an overt conflict style influences children's and adolescents' adjustment negatively (Buehler et al., 1997; Buehler et al., 1998). Exposure to destructive parental conflict tactics predicted immediate aggressive responses and a higher likelihood of externalizing behavior problems of 8- to 16-year-old children and adolescents in a home based diary study (Cummings, Goeke-Morey, & Papp, 2004). Therefore, interparental conflict from both the perspective of the mother and the early adolescents was considered as a psychosocial source of stress in the present study.

Interparental conflict has also been linked to adolescents' sleep disruptions assessed with actigraphy through the effect of increased emotional insecurity (El-Sheikh et al, 2007). Further, higher levels of parental warmth and monitoring of household rules related to longer sleep duration on weekday nights in a large nationally representative sample of children and adolescents (Adam, Snell, & Pendry, 2007). The present study extends these observations on the link between familial functioning and adolescents' sleep by focusing on sleep duration and irregularity of sleep and their role as moderators of the relation between interparental conflict and adolescents' aggression.

For the present study three hypotheses were formulated: (1) we expected that short sleep duration and a large weekday-to-weekend difference in sleep duration is associated with higher levels of aggression in early adolescents; (2) we expected that interparental conflict is

related to adolescents' higher levels of aggression, and (3) we expected that short sleep duration and a large weekday-to-weekend difference in sleep duration moderates the association between (a) mother- and adolescent-rated interparental conflict and (b) early adolescents' aggression. In particular, we expected that adolescents with short sleep duration and a large weekday-to-weekend difference in sleep duration were more vulnerable to the impact of interparental conflict.

Method

Procedure

This study is based on the second assessment of an ongoing longitudinal study in the German-speaking part of Switzerland on the influence of dysfunctional family processes on children in transition to puberty. Most of the families (77.3%) were recruited through their children's schools in the city of Basel, Switzerland, and the surrounding area. Trained university students presented information about the study to fourth-grade students in their classrooms, who then brought informed-consent letters home to their parents. A smaller percentage of the families (22.7%) were recruited through residents' registration offices. The average response rate was 17.0% (22.6% for school recruitment and 10.5% for recruitment through residents' registration offices), which is comparable to other studies including several family members (e.g., 17.8% by Davila, Karney, Hall, & Bradbury, 2003).

Parents signed statements of informed consent and children provided assent before participating. The entire study has been carried out in accordance to the ethical standards for research involving human subjects required by the University of Basel and laid down in the Declaration of Helsinki (World Medical Association, 2008, online at www.wma.net). Mothers and children participated in standardized interviews with trained interviewers and completed

questionnaires during a two-hour session at their homes. Mothers and children each received 15 Swiss Francs (equivalent to 13 U.S. Dollars) for participation.

Participants

The sample at time 1 (spring/summer 2008) consisted of $N = 246$ fourth graders and their mothers. Of these 246 families, 228 participated again at time 2 (spring/summer 2009; attrition rate of 7.3%). As sleep variables were only assessed at time 2 and interparental conflict was only assessed in two-parent families, we here refer to a subsample of 176 two-parent families, which still participated at time 2. The subsample included 87 boys and 89 girls with mean age of 11.6 years ($SD = 0.39$, range = 10-13 years). The majority of the mothers (94.3%; $n = 166$) were married for an average of 15.6 years ($SD = 4.75$) at time 2. Most of the mothers were Swiss (81.8% of mothers) and their average age was 42.7 years ($SD = 4.83$). A minority of 7.4% of mothers had completed only the 9 years of compulsory schooling, the majority finished a formal job training (67.6%), and 24.4% had a university degree. Thus, the sample was biased toward higher education compared to the Swiss population (Federal Statistical Office, 2009).

Measures

Interparental conflict was assessed by both, mother report of negative interparental conflict behavior and early adolescents' report of perceived threat imposed by interparental conflict.

Negative Interparental Conflict Behavior. Negative interparental conflict behavior was measured by an aggregation of five separate scales rated by the mother, i.e., a) mother's and b) father's conflict engagement; c) mother's and d) father's withdrawal from the Conflict Resolution Styles Inventory (CRSI, Kurdek, 1994; see also Siffert & Schwarz, 2011); and e) conflict frequency (Reichle, 2005). Mothers' ratings on their own and their partners' conflict engagement and withdrawal included four items each (e.g., Conflict Engagement: "Letting

myself go, and saying things I do not really mean"; Withdrawal: "Not listening to the partner anymore"). The scale Conflict Frequency asks for the frequency of the occurrence of various conflict topics (e.g., "How often do you and your partner have disagreements concerning housekeeping?"). Answers were given on a 5-point rating scale ranging from 1 (never) to 5 (always), with higher mean scores indicating more frequent use of such negative behavior. The internal consistency of the whole scale comprising these five indicators of negative interparental conflict behavior was good with Cronbach's alpha of .74.

Early adolescents' appraisal of threat imposed by interparental conflict. Children's appraisal of threat was assessed with a subscale from the Children's Perception of Interparental Conflict Scale for younger children (CPIC-Y; McDonald & Grych, 2006; German adaptation by Schwarz & Siffert, 2010). Children rated six items (e.g., "I get scared when my parents have disagreements; Cronbach's alpha =.89) on a 5-point rating scale ranging from 1 (never) to 5 (very often). Higher mean scores indicating higher levels of perceived threat. Early adolescents' perceived threat was significantly correlated with mother ratings of negative interparental conflict behavior (r = .22, p = 0.005, n = 157).

Sleep duration. To assess sleep duration the Sleep Habits Survey (SHS, Wolfson & Carskadon, 1998) was translated into German. In the current study only items asking early adolescents at what time they usually go to bed and when they get up (a) on schooldays, and (b) on weekends were used. Thus, the time in bed was used as a proxi of the sleep duration. Weekday-to-weekend difference in sleep duration was calculated as the absolute difference of sleep duration on weekdays and weekends.

Early adolescents' aggression. A six-item German self-report version of the Aggression subscale of The Revised Class Play Method (RCPM; Masten, Morison, & Pellegrini, 1985) was completed by the early adolescents. A sample item from the RCPM was "I get into a lot of fights" (Cronbach's alpha = .84). The items were rated on a 4-point Likert-type scale

ranging from 1 (does not apply) to 4 (applies completely). Thus, higher scores point to higher levels of aggression.

Pubertal status. Pubertal status was used as a control variable in the analyses. We used the Pubertal Development Scale (Petersen, Crockett, Richards, & Boxer, 1988; German adapton by Watzlawik, 2009). Boys rated the status of their pubertal status with respect to pubic hair, growth of beard, and vocal change on a 4-point rating scale ranging from 1 (has not begun yet) to 4 (comparable to an adult). Girls rate their pubertal status concerning pubic hair and development of the breasts comparable to the boys. Further, a dichotomous indicator of Menarche (yes/no) was included. The sum score was divided into five graduations ranging from 1 (prepuberty) to 5 (postpuberty).

Girls and boys did not differ in sleep duration on weekday nights and weekends. Further, their weekday-to-weekend difference in sleep duration was not significantly different (all *p*s > 0.07). Generally, boys were less advanced than girls in pubertal development (boys: M=1.87, SD=0.70; girls: M=2.93, SD=0.68; t=11.50, $p < 0.001$) and they rated themselves as more aggressive (boys: M=1.83, SD=0.61; girls: M=1.51, SD=0.44; t=4.51, $p < 0.001$). There were no gender differences in family income and both ratings of interparental conflict (all *p*-values > 0.17).

Statistical analysis

Data analyses were conducted using SPSS 17.0 (SPSS Inc., Chicago, IL). Hierarchical regression analyses were applied to test the extent to which a) sleep duration on weekdays and weekends, as well as weekday-to-weekend difference in sleep duration was related to adolescent aggression, b) interparental conflict was associated with adolescent aggression, and c) whether the sleep measures moderated the relations of interparental conflict with adolescent aggression.

With respect to the moderator analyses we followed the suggestions of Aiken and West (1991) for moderated regression analyses. First, indicators of interparental conflict and difference in sleep duration were standardized to avoid multicolliniarity between interaction variables and predictors. Second, six multiplication terms of standardized conflict measures (negative interparental conflict behavior and perceived threat), with the sleep measures (sleep duration on weekdays and weekends, and weekday-to-weekend difference in sleep duration) were calculated. Separate hierarchical regressions each introduced interparental conflict measures and sleep measures in Step 1, while "interparental conflict x sleep-interaction terms" were each introduced in Step 2 of the hierarchical regressions. Significant interaction effects indicated that the relations between interparental conflict measures and adolescents' aggression differed in strength and/or direction depending on the degree of sleep duration/irregularity. Finally, for a closer inspection of the moderator effect, simple slope test with the conflict indicators at 1SD below and 1SD above the mean of the moderator (sleep variables) were conducted.

As an index of effect size R^2-change was calculated for interparental conflict measures as well as for sleep measures as entered in separate steps of hierarchical regressions each controlling for child's gender and pubertal status, and family income. R^2-change for the interaction terms was also calculated in separate steps of hierarchical regressions each controlling for main effects of corresponding interparental conflict measures and sleep measures, as well as for child's gender and pubertal status, and family income. Child's gender, pubertal status, and family income were controlled in all models given the often reported effects of gender and family SES on adolescent aggression (Loeber & Hay, 1997) as well as the change in sleep behavior related to the onset of puberty (Laberge et al, 2001).

Results

Table 1 presents descriptive statistics of the study variables. On average, the participating young adolescents slept 9.76 hours (*SD* = 0.67) on weekdays and 10.71 hours (*SD* = 1.29) on weekends. Average bed- and waking times were at 8:59pm (*SD* = 34 min) and 6:45am (*SD* = 23 min) for weekday nights, and 10:23pm (*SD* = 60 min) and 9:06am (*SD* = 74 min) for weekend nights. The average absolute difference between weekday and weekend sleep duration was 1.35 hours (*SD* = 0.98).

A majority of the young adolescents (*n*=186; 83.4%) slept longer on weekends than on weekday-nights (*M* = 1.38h; *SD* = 0.97; max = 6h) while a minority of 37 young adolescents (16.6%) slept shorter on weekends than on weekday-nights (*M* = 1.15h; *SD* = 1.01; max = 4.5h). Adolescents who sleep shorter on weekends did not differ on other study variables from their counterparts who sleep longer on weekends (all *p*-values > 0.19).

Table 1 also presents correlations of all study variables. Sleep duration on weekdays and weekends, as well as weekday-to-weekend difference in sleep duration were not related to gender, pubertal status, income, and interparental conflict (all *p*-values > 0.08).

(Insert Table 1 about here)

Table 2 presents moderated regression analyses of adolescent aggression predicted by interparental conflict (negative interparental conflict behavior rated by mothers and perceived threat rated by adolescents) and sleep measures, and their interaction terms that were entered into the regression in a second step; all moderated regression analyses further controlled adolescents' gender, pubertal status, and family income. Both indicators of interparental conflict were positively related to adolescent aggression. Sleep duration on weekdays and weekends, as well as weekday-to-weekend difference in sleep duration were not directly related to adolescent aggression (all *p*-values > 0.20). The interactions of negative interparental conflict behavior with sleep duration on weekdays and with weekday-to-weekend difference in sleep duration were significant ($p = 0.04$, R^2change = 0.02; and $p =$

0.003, R^2change = 0.05, respectively). In a similar vein, the interactions of perceived threat rated by adolescents with sleep duration on weekends and with weekday-to-weekend difference in sleep duration were significant (p = 0.004, R^2change = 0.05; and p = 0.02, R^2change = 0.03, respectively).

(Insert Table 2 about here)

For the significant interactions, simple slopes were calculated and are presented in Figure 1. Negative interparental conflict behavior was significantly and positively related to adolescent aggression only among adolescents with short sleep on weekdays (b = .27, p = .006 compared to b = .06, p = .53 for adolescents with long weekday sleep; Figure 1A) or a large weekday-to-weekend difference in sleep duration (b = .31, p < .001 compared to b = .03, p = .76 when the difference was small; Figure 1B). Additionally, perceived threat rated by adolescents was significantly and positively related to adolescent aggression only among adolescents with long sleep on weekends (b = .31, p = .001 compared to b = .04, p =.75 when the weekend sleep duration was short; Figure 1C) or a large weekday-to-weekend difference in sleep duration (b = .29, p = .003 compared to b = .04, p = .72 when the difference was small; Figure 1D).

(Insert Figure 1 about here)

Finally, the hierarchical regression analyses with weekday-to-weekend difference in sleep duration as moderator were rerun after exclusion of adolescents who slept longer on weekday nights than on weekends (N=37). The exclusion did not affect the direction and significance of the results (data not displayed).

Discussion

First, we expected short sleep duration and a large weekday-to-weekend difference in sleep duration to be associated with higher levels of aggression in early adolescents. In contrast to earlier research (e.g., Haynes et al., 2006) no direct association of sleep duration or

irregularity of sleep with adolescent aggression could be revealed. A possible reason for the failure to replicate this finding might be due to rather high parental educational background and socioeconomic status and therefore probably less adversity and hardship in our sample compared to earlier studies with samples of adolescent drug dependents under behavioral sleep treatment (Haynes et al., 2006). A further explanation of the lack of association between sleep measures and adolescents' aggression in the present study might be that only sleep duration was assessed. Testing the relationship between sleep quality and aggression might have brought out different results. The finding of no relation between short and irregular sleep with adolescents' aggression is, however, in line with results from a recent actigraphy based study with a community sample of 14-year old adolescents by Moore et al. (2009) who could not find a direct relation of short and irregular sleep with health outcomes. Further, we studied a somewhat younger age group than Haynes et al. (2006), i.e., adolescents at the onset of puberty; across adolescence and with pubertal development large changes in sleep habits occur (Iglowstein et al., 2003; Laberge et al., 2001) and findings in older adolescence do not necessarily apply for early adolescents.

Second, we hypothesized interparental conflict to be related with higher levels of aggression in early adolescents. In line with numerous studies on the impact of interparental conflict on externalizing problems of children and adolescents (Buehler et al, 1997; Buehler et al., 1998; Reid & Crisafulli, 1990) we found significant relations between interparental conflict and early adolescents' aggression irrespective of whether mothers reported negative interparental conflict behavior or adolescents reported their appraisal of threat– this although maternal reports and adolescents' perception of interparental conflict only correlated moderately.

Third, we hypothesized that short sleep duration and a large weekday-to-weekend difference in sleep duration moderates the association between mother- and adolescent-rated

interparental conflict and early adolescents' aggression. In agreement with the hypotheses, findings indicate an interaction of these sleep variables with interparental conflict. Specifically, we found that mothers' perception of negative interparental conflict behavior was related to aggression among adolescents who slept short on weekdays and among adolescents with a large weekday-to-weekend difference in sleep duration. Further, we found that perceived threat of interparental conflict was associated with aggression among adolescents who slept long on weekends or who showed a large weekday-to-weekend difference in sleep duration.

The findings that a short sleep duration on weekdays and a long sleep duration on weekends associate with an increased susceptibility to interparental conflict appear to fit into the picture of one dysfunctional sleep schedule characterized by short sleep during the school week which leads to an increasing sleep debt, and by long catch-up sleep on weekends to reduce the sleep debt (Dahl & Lewin, 2002). Even more specifically, this sleep schedule was characterized by late bedtimes on schooldays and late wake times on weekends, whereas wake times on weekdays only show a small variance due to fixed school start times. While our sample also included a small minority who slept shorter on weekends than on weekdays, the study results remain essentially similar in direction and strength after exclusion of these individuals from the analyses.

Generally, the moderation of the effect of interparental conflict on adolescent aggression is consistent with the prediction from a vulnerability-stress model (e.g., Seiffge-Krenke, 2000; Walker et al., 1989). Adolescents with shorter sleep on weekdays or larger weekday-to-weekend difference in sleep duration appear to be more vulnerable to the psychosocial stress imposed by interparental conflict. The interpretation of increased vulnerability to stress due to short and irregular sleep is consistent with various lines of evidence. First, correlational studies with adolescents show that short and irregular sleep may

increase daytime sleepiness, concentration difficulties, and mood disturbances which in turn may fuel a state of vulnerability (see e.g., Brand et al., 2009; Moore et al., 2009; Wolfson & Carskadon, 1998, 2003). Second, the findings are in line with the postulate of a common jet-lag like syndrome due to divergent scheduling of the sleep phases on weekdays and weekends which may lead to a mental state characterized by fatigue and irritability eventually increasing vulnerability in affected adolescents (Dahl & Lewin, 2002). Third, from experimental studies with adults we know that sleep deprivation may lead to higher impulsivity, to hamper self-regulation and to impede adaptive coping with stress (Kahn-Green et al., 2006; Killgore et al., 2008). It remains a task of future research to confirm short and irregular sleep as vulnerability factors and to explore possible psychological or endocrine substrates of increased vulnerability to stressors. One possible mediator of vulnerability may be the dysregulation of the HPA-axis (Buckley & Schatzberg, 2005; El-Sheikh et al., 2008; Omisade et al., 2010).

Limitations to our study include the use of adolescent self-report to assess sleep times as self-report measures may cause unreliability due to memory distortions as compared to objective assessment of sleep by polysomnography or actigraphy. As we asked the young adolescents for their normal bed- and wake times and derived sleep duration from these indices, particularly adolescents with troubles falling asleep or maintaining sleep may also spend a considerable amount of this time in bed awake. However, earlier research (Brand et al., 2010; Wolfson et al., 2003) has shown that young adolescents provide reliable estimates of their sleep times and duration. Another limitation of the present study is its exclusive focus on sleep duration and irregular sleep patterns while we do not address possible consequences of sleep problems or low sleep quality which have been reported to affect externalizing and aggressive behavior (Goodnight, Bates, Staples, Pettit, & Dodge, 2007; Wong, Brower, & Zucker, 2009).

Further, additional use of other sources of information on adolescent aggression as teacher and peer reports might increase objectivity and validity of the measurement of aggressive behavior. On the other hand, we consider it a strength of the study that interparental conflict was rated by the mothers and by the young adolescents who indicated how much they felt threatened by the conflict of their parents. For both mother and adolescent ratings, a similar picture emerged that irregular sleep moderated the association of interparental conflict with adolescent aggression. Finally, on a more general note, one has to keep in mind that no causal conclusions may be drawn based on our findings, as the current study employed only cross-sectional data and did not involve experimental treatment of the variables under study. Therefore, several different explanations of our findings remain possible. For example, it is possible that interparental conflict in interaction with adolescent aggression may hamper the adolescents' sleep patterns (see for instance El-Sheikh et al. 2007). By contrast, it is also possible that adolescents' characteristics adversely affect parents' communication and thus impact on parental conflict (Wymbs & Pelham, 2010).

In sum, our results add to the picture that sufficient and regular sleep is an important variable for healthy development in young adolescence. Sleep restriction and irregularity of sleep may increase the susceptibility to psychosocial stressors such as interparental conflict. On the other side, sufficient and regular sleep may add to resilience in the face of such adversities. The findings are also of potential practical importance for parents who would like to support their adolescent children's socioemotional development and well-being as well as for clinicians who counsel aggressive young adolescents and their parents.

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Table 1

Descriptive Statistics and Correlations of Pubertal Status, Family Income, Interparental Conflict Behavior, Sleep Variables, and Adolescents' Aggression

		M	SD	1.	2.	3.	4.	5.	6.	7.
1.	Pubertal status	2.40	.87	-						
2.	Family income (CHF)	110489	49692	-.15*	-					
3.	Negative Interparental Conflict Behavior (mother rating)	2.06	0.58	-.04	-.13	-				
4.	Perceived Threat (adolescent rating)	2.07	0.97	.01	-.10	.22**	-			
5.	Sleep Duration weekday (h)	9.76	0.67	.01	-.03	.00	-.02	-		
6.	Sleep Duration weekend (h)	1.71	1.29	.06	-.12	-.10	.05	.15*	-	
7.	Weekday-to-Weekend Diff (h)	1.35	0.98	.08	-.03	.09	.13	-.37***	.37***	-
8.	Aggression (adolescent rating)	1.67	0.55	-.15*	.07	.17*	.20**	-.07	-.09	.03

*$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

Table 2

Summary of Hierarchical Regression Analyses examining Main and Interaction Effects of Indicators of Interparental Conflict and Adolescents' Sleep Patterns on Adolescents' Aggression (Standardized Regression Coefficients)

	Negative Interparental Conflict Behavior (mother rating) as Predictor			Perceived Threat (adolescent rating) as Predictor		
	Weekday Sleep duration as Moderator	Weekend Sleep duration as Moderator	Weekday-to-Weekend Diff as Moderator	Weekday Sleep duration as Moderator	Weekend Sleep duration as Moderator	Weekday-to-Weekend Diff as Moderator
Step 1						
Gender	-.37***	-.36***	-.37***	-.39***	-.38***	-.39***
Pubertal status	.18	.17	.17	.15	.15	.14
Family income	.10	.10	.10	.12	.11	.11
Predictor (Marital conflict indicator)	.21**	.21**	.21**	.24**	.25**	.24**
Δ R^2 of marital conflict indicator (separate Step)	0.04**	0.04**	0.04**	0.06**	0.06**	0.06**
Moderator (Sleep pattern indicator)	-.06	-.04	.04	-.06	-.05	.07
Δ R^2 of sleep pattern indicator (separate Step)	0.00	0.00	0.00	0.01	0.00	0.01
Step 2						
Predictor X Moderator	-.17*	.13	.23**	.05	.22**	.19*
Δ R^2 of interaction (Step 2)	0.02*	0.01	0.05**	0.00	0.05**	0.03*
Total R^2	0.14***	0.13**	0.16***	0.17***	0.22***	0.21***

Note. The displayed coefficients at step 1 represent the values before inclusion of interaction terms at step 2. For calculation of Δ R^2 of the predictor and the moderator, the variables were included in a separate step each only adjusting for gender, pubertal status, and family income. For predictor in the respective analysis see first line of the table; for moderator in the respective analysis see second line of the table.

*$p < .05$. **$p < .01$. ***$p < .001$.

Figure Caption

Figure 1. Simple slopes for the significant interaction effects indicating the moderator function of irregular sleep patterns. Relationship between indicators of interparental conflict and adolescents' aggression at high and low levels of the indicators of sleep patterns: (A) negative interparental conflict behavior and weekday sleep duration, (B) negative interparental conflict behavior and weekday to weekend difference in sleep duration, (C) adolescents' perceived threat and weekend sleep duration, and (D) adolescents' perceived threat and weekday to weekend difference in sleep duration.