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Sharon R. Turlington
San Jose State University

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SELF-ESTEEM IN ADOLESCENT GIRLS:
THE INTERACTION OF SLEEP, PUBERTY, AND AGE

A Thesis

Presented to

The Faculty of the Department of Psychology
San José State University

In Partial Fulfillment

of the Requirements for the Degree

Master of Arts

by

Sharon R. Turlington

December 2009

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SAN JOSE STATE UNIVERSITY

The Undersigned Thesis Committee Approves the Thesis Titled

SELF-ESTEEM IN ADOLESCENT GIRLS:

THE INTERACTION OF SLEEP, PUBERTY, AND AGE

by

Sharon R. Turlington

APPROVED FOR THE DEPARTMENT OF PSYCHOLOGY

Arlene Asuncion, Ph.D., Professor, San Jose State University
10/23/09
Date

Mildred Alvarez, Ph.D., Professor, San Jose State University
10/23/09
Date

Ian Colram, Ph.D., Director, Human Sleep Research Laboratory, SRI
Adjunct Professor, University of Melbourne
10/25/09
Date

APPROVED FOR THE UNIVERSITY

Associate Dean Office of Graduate Studies and Research
2/5/10
Date

ABSTRACT

SELF-ESTEEM IN ADOLESCENT GIRLS: THE INTERACTION OF SLEEP, PUBERTY, AND AGE

by Sharon R. Turlington

Adolescence is a period of dramatic physical, social, and emotional development and of increased vulnerability for development of psychological problems, especially in girls. Alterations in sleep composition, behavior, and timing are particularly dramatic, often leading to chronic sleepiness that amplifies other psychological issues. The present study investigated the relationship between pubertal changes, sleep changes, and self-esteem changes in a cross-sectional sample of adolescent girls all attending a single sex middle school. Sleep time decreased, circadian phase became delayed, sleepiness increased, and self-esteem decreased from 6th to 8th grade, as anticipated. A novel finding was an interaction between sleep quality, pubertal status, and self-esteem. There was no difference in self-esteem between good and poor sleeping pre-menarcheal girls. However, post-menarche, poor sleepers had dramatically lower self-esteem than good sleepers. This highlights the possibility that intervention in sleep might provide a window of opportunity to assist self-esteem in this vulnerable population.

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Introduction

Adolescence is a time of rapid and dramatic physical and psychological change, traditionally referred to as a period of storm and stress (Hall, 1904). Along with societal pressures, the transition from childhood to adulthood is associated with numerous biological, physiological, and social changes. During the progression through puberty, adolescents experience increases in hormone production (Gupta, Rager, Attanasio, Klemm, & Eichner, 1975), physical changes to their body, alterations to their self-esteem (Savin-Williams & Demo, 1984; Simmons, Rosenberg, & Rosenberg, 1973), and major changes in their sleep-wake cycles (1998). The present study will examine the interaction of pubertal and sleep maturation on self-esteem levels in adolescent girls.

Adolescence

Adolescence is recognized as a socially- and culturally-constructed period of the life by scholars in the field of developmental psychology (Arnett, 2007). Typically the period is viewed as beginning when the first outward signs of puberty occur (age 10 for girls in most developed countries; age 12 for boys) and ending once adulthood begins (between 19- and 25-years). The age range of 10-19 years appears to be the general rule of thumb for inclusion of children in studies of adolescence.

A noticeable sign of the transition into the adolescent period is the initiation of physical changes associated with puberty; adolescent girls and boys make the transition from looking like children to looking like adults (Graber & Brooks-Gunn 1996; Petersen & Taylor, 1980). Another related change during puberty occurs within the endocrine system, primarily involving increases in gonadal hormones (androgens, estrogens, and

progesterone). Endocrine changes presumably underlie the somatic changes (body size and shape, and development of secondary sex characteristics), but it is the physical changes that seem to be more strongly related to social and psychological trends because of their visibility (Petersen, Crockett, Richards, & Boxer, 1988). Girls and boys experience these changes differently; boys view puberty more positively possibly because for them the physical changes involve increasing muscle mass which is a more socially desirable trait, while changes for girls include increasing body fat percentage causing their body morphology to change and be farther from the societal ideal of thin (Angold, 1999). Prevalent reports of higher levels of depression (Patten, 2000; Angold, 1999; Wichstrom, 1999), lower levels of self-esteem (Schraedley, Gotlib, Hayward, 1999; Simmons, Rosenberg, & Rosenberg, 1973), and increased levels of sleep disturbances (Carskadon, Vieira, & Acebo, 1993; Cleckner-Smith, Christine, & Doughty, 1998; Knutson, 2005) in girls compared to boys, during adolescence indicate that during this time girls may be more susceptible to negative outcomes from the effects of pubertal development. In addition, the fact that girls experience pubertal changes earlier than boys (Dahl, 2004; Marshall & Tanner, 1969) means that they are exposed to the potential negative effects of puberty even earlier in development.

One of the first scales created and widely used for determining pubertal status was the Sexual Maturation Scale, developed by Tanner (1960), which uses changes in height, weight and growth of secondary sex characteristics as an index of pubertal development. It relies on physician rating, from immature to developed (Stage I-V), on the development of physical changes in children: pubic hair, and breasts (in girls) or growth

of external genitalia (in boys). Other studies have demonstrated that the development of these characteristics using the scale is related to endocrine increases (Gupta et al., 1975), height (Tanner, Whitehouse, Marubini, & Resele, 1976), and other changes associated with puberty (Marshall and Tanner, 1969). The original Tanner scale required physical assessment of each child by a physician; however, to accommodate large scale assessment of development when physician assessment was not feasible, interview and pictorial versions of the scales were created. More recent versions of the scale have been adapted utilizing self report and written responses as opposed to pictorial association or physician assessment for ease in administration in school and other large scale public settings, where pictures of secondary sex characteristics were not allowed (Petersen, Crockett, Richards, and Boxer, 1988; Acebo & Carskadon, 1993). The Pubertal Development Scale (PDS); (Petersen, Crockett, Richards, and Boxer, 1988), in addition to assessing body hair growth and secondary sex characteristics, also obtains ratings on skin changes, growth spurt timing, menarche (for girls) and voice change (for boys). The PDS allows calculation of a Tanner stage score in addition a continuous development variable and a PDS category score. The Reliability and validity of these scales have been tested and compared with physician ratings and found to be accurate in assessing level of puberty development (Petersen, Crockett, Richards, and Boxer, 1988).

Adolescents are at increased susceptibility for psychopathology, especially depression (Kandel & Davies, 1982). During late childhood (9-12 years) boys present a similar rate, or higher, of depressive symptoms as girls, but during the teenage years the rate in girls becomes twice that of boys (Wichstrom, 1999). Findings as to the exact

timing of when girls surpass the boys in depression rates are varied, but it has been suggested that it is more related to pubertal development than chronological age (Angold et al., 1999); indicating that there is something involved in the changes associated with pubertal that differentially exposes girls to factors that may lead to depression (Kandel & Davies, 1982). One explanation for this is that physical changes brought on by puberty in girls causes their view of themselves to be altered which affects how they feel about themselves. One of the principles of self-esteem formation is social comparison; girls judge themselves on the basis of comparisons with others and are strongly influenced by the judgments of what others think of them (Rosenberg, Schooler & Schoenbach, 1989). Girls are bombarded with images of the ideal body type and when their actual body is very different from their ideal it can lead to uncomfortable feelings and a lower level of self-esteem (Schraedley, Gotlib, Hayward, 1999). Low self-esteem has been shown to be one factor that can lead to the development of depression (Rosenberg, Schooler & Schoenbach, 1989) which indicates that a measure of self-esteem may have further important implications in the development of psychopathology

Self-Esteem

As girls progress through puberty they can experience lowered self-esteem (Simmons, Rosenberg, and Rosenberg, 1973). Harter (1990) defined self-esteem as how much a person likes, accepts, and respects herself as a person overall. Two theoretical perspectives have been taken into account by self-esteem researchers in trying to define and operationalize self-esteem (Harter, 1990; Rosenberg, 1989). The first perspective encompasses the view of William James who viewed self-esteem as the ratio of a

person's perceived success in a certain domain to the importance a person attaches to success in that domain; in other words a higher self-esteem will be viewed if a person performs well in a realm that she believes is of more importance to her (James, 1950). This perspective has come to be important in self-concept theory which focuses on the multi-dimensionality of self-concept. The second perspective is from Cooley, who considered self-esteem as originating with the person's perceptions of how significant others viewed the self (Cooley, 1956). To some extent the views of others factor into a person's measure of their own self-esteem. During adolescence the views of others can include many different people (peers, parents, and teachers) who may all offer conflicting perceptions on what value to place on specific areas of life (Berndt, 2002; Marcotte, Fortin, Potvin, & Papillon, 2002; Rosenberg, 1989) leading to uncertainty about oneself. Cooley's perspective is an important part of self-esteem theory (Rosenberg, 1989) which considers the principles of self-esteem formation as reflected appraisal, social comparison, and self-attribution. Most current research on self-esteem deals with a global measure of self-esteem that encompasses the individual's positive or negative attitude toward the self as a totality (Rosenberg et al., 1995).

Self-esteem is regarded as an aspect of one's social and cognitive development, with the early adolescent years being somewhat volatile and yielding substantial shifts from one year to the next (Berndt, 2002). Studies which have addressed the question of whether self-esteem changes over time have produced conflicting results. In a cross-sectional study of adolescent self-esteem, Simmons, Rosenberg, and Rosenberg (1973) found that self-esteem dropped during early adolescence, with the greatest decrease at

age 12. From that point it gradually increased, with a burst at age 16. However, Savin-Williams and Demo (1984) measured self-esteem in different domains, longitudinally in seventh through tenth graders (13-16-year-olds) and found gradual increases in evaluations of the self, concluding that overall self-esteem is a “stable”, enduring aspect of the personality; they did not, however, reported differences between boys and girls, instead the combined results were presented. In contrast, in a recent review, Kling et al. (1999) found significant differences across the lifespan, with the largest effect emerging as a sharp decline of self-esteem in adolescence. Additionally, they investigated potential gender differences in self-esteem and found that women had a lower global self-esteem than men. This gender difference in self-esteem may emerge during adolescence: Rosenberg and Simmons (1975) found that more girls reported lower self-esteem than did boys during middle and late adolescence, aged 12-15, but not between the ages of 8 and 11. Adolescent girls experience genuine, substantial drops in self-esteem and self-confidence, and though boys also have a drop in self-esteem at this age it is much greater for girls (Angold, 1999). Lowered self-esteem for girls is accompanied by a loss of enthusiasm for math and science, a decline in performance on standardized science tests, less confidence in their academic abilities, and fewer aspirations to professional careers (Kling et al., 1999; O'Malley & Bachman, 1979). Lower levels of self-esteem can prevent girls from having or acting on high aspirations for academic accomplishment or future successes. Of interest to note is that these studies looked solely at age (as a measure of adolescence) without regard for pubertal development, and that not all studies focused specifically on the period of adolescence.

Proponents of single-sex education point to the gender differences that have been found in levels of self-esteem, especially related to the math and sciences, during adolescence as support for single sex environments in education. They propose that without the negative effects of boys, girls will show smaller decreases in their self-esteem in academic domains. Single-sex education for girls is designed to head off this detrimental decline in self-esteem before it begins by eliminating the opportunity for girls to experience gender-based stereotyping in certain academic domains. In studies of differences in self-esteem and levels of delinquency in single-sex versus co-educational high school environments results are varied, but some show that girls derive no added benefit from co-educational environments, but that boys do (Brooks-Gunn & Warren, 1989; Caspi, Lynam, Moffitt, & Silva, 1993). This study looks at a sample of girls attending a single-sex school in an attempt to see if they are still subject to a drop in self-esteem.

One issue left unclear with the previous research is what initiates or plays a role in the differential changes in self-esteem for girls and boys. Therefore, there is a need for further research about factor that might influence self-esteem during adolescence, particularly in girls. One important concern is how the researchers have defined development; in the self-esteem research most studies look at chronologic age as opposed to specifically looking at an index of pubertal status to determine level of development. It is possible that physical, emotional, and behavioral changes associated with pubertal development may directly influence levels of self-esteem more so than chronological age.

Sleep

One factor that has received little attention in the literature as having a potential impact on self-esteem in adolescence is sleep behavior. Yet, sleep is essential for health and well being, and is dramatically altered by adolescent development. The ability of adolescents to think, behave, and function during daytime hours can be critically impacted by the quality of sleep. Sleep loss in adolescents has been associated with changes in mood, and motivation, and has been found to lead to the development or exacerbation of behavioral and emotional problems (Dahl, 1996). Irritability, lack of self confidence and mood swings are often common in a teen, but sleep deprivation can make them worse.

It has been shown that the amount of sleep an individual needs decreases from childhood to adulthood; Strauch and Meier (1988) have reported that on average children need 10 hours of sleep and adults need 8 ¼ hours of sleep. Research on adolescent sleep patterns has consistently found that they go to bed later at night and get significantly less sleep than children. Because of these findings it was thought that adolescent sleep was more like adult sleep and that their sleep need was closer to 8 ¼ hours rather than 10 hours. More recent laboratory findings have shown that adolescents actually do not have a decreased sleep need during puberty and that the average sleep need during puberty is 9 ¼ hours of sleep (Carskaddon, 1990; Carskadon et al., 1980; Carskadon, Orav, & Dement, 1983). Reports from survey data show that teenagers are getting closer to 7.5 hours (Allen, 1992; Carskadon, 1990) which is an indicator that there is a major

discrepancy between the sleep required and the actually sleep being gotten by adolescents and may be a reason there is also a sharp increase in daytime sleepiness during this age.

Laboratory studies assessing objective measures of sleep show that the architecture of sleep changes dramatically across adolescence (Ohayon et al., 2004). Slow wave sleep (SWS) is a metric used in sleep EEG studies and is a measurement of the amount of time a person spends in stages 3 and 4 (marked by the percentage of delta frequency waves per epoch according to Rechtschaffen and Kales, (1968) during a night of sleep. The amount of SWS, decreases by approximately 40% across puberty (Carskadon, 1982), with production of delta activity decreasing by about 3.5% per year between childhood and young adulthood (Feinberg et al., 1990). Current concepts depict SWS as serving a critical role in developmental and learning-induced plasticity, by playing a critical role in “recovery” from daytime activities. Studies that measure the intensity of the delta waves (SWA) in SWS have found that power density of SWA is 37 percent higher in 12-year-old boys than in girls of the same age, which indicates a gender difference in measures of sleep EEG (Feinberg, Higgins, Khaw, & Campbell, 2006).

Findings have been contradictory with regard to whether adolescent girls and boys have different sleeping patterns. Wolfson and Carskadon (1998) found no correlation between extended weekend sleep and gender, however LaBerge et al. (2001) showed as girls sleeping later on weekends than boys. Several studies have reported that adolescent girls have earlier wake up times during the school week and have hypothesized that this is due to the need for more extensive grooming routines (Gau and Soong, 1995; Wolfson & Carskadon, 1998). In their longitudinal study of adolescents

across grades 6-8 (11-14-year-olds) Fredriksen et al. (2004) found that sleep amounts decreased for all adolescents, however, the decrease occurred at a younger age for the girls than for the boys.

At some point during puberty, in addition to fluctuating levels of gonadal hormones, the body delays the time at which the sleep-related hormone melatonin is secreted by the pineal gland (Cavallo, 1992). This change in secretion time leads to a delayed circadian clock, essentially shifting the waking and sleeping time frame of the child later (as in coming off of daylight savings, or flying westward across time zones). The result is an adolescent who does not feel sleepy or tired until 11pm (sometimes even later) when previously they may have feeling tired and going to bed at 9pm. Carskadon, Vieira, and Acebo (1993) have shown that the shift in phase preference is related to pubertal status, with girls showing a significant correlation of more advanced pubertal status with preference for eveningness (later phase); boys showed a similar trend but it was not significant. This shift towards eveningness is associated with increases in daytime sleepiness in adolescents due to later bedtimes. If the adolescent was able to accommodate this later sleep time by sleeping in later in the morning (thus completing shifting their sleep/wake pattern) there possibly would not be a problem. Unfortunately, due to early start times of schools adolescents with a strong phase shift end up having their overall sleep restricted.

Another indicator of adolescent sleep deficiency can be seen by looking at how much sleep they are getting on weekends, specifically how different weekend sleep is from sleep during the week. Previous studies have reported that weekend total sleep

times average 30-60 minutes more than school nights for 10- to 13- year olds, and this difference steadily increases up to 2 hours by age 18 (Bearpark & Michie, 1987; Petta, Carskadon, & Dement, 1984, Strauch & Meier, 1988). The most accepted interpretation of this is that adolescent's use the weekend as an opportunity to catch up on the accrued sleep debt from the week. Unfortunately, for adolescents the combination of insufficient school-night sleep, from later bedtimes and inflexible wake times, in the presence of a consistent physiological need for sleep results in some degree of chronic sleep loss.

The changes in sleep behavior that are evident across adolescence may influence mood and self-esteem. There is a strong association between poor sleep quality and depressed mood that begins in adolescence (Vallido, Jackson, & O'Brien, 2009). Also, there is evidence from one study that having less sleep is associated with lower levels of self-esteem in male and female adolescents, however this study only looked at one aspect of sleep behavior and did not assess level of pubertal development (Fredriksen, et al., 2004). There is therefore a need for further study of the potential association between changes in sleep behavior and self-esteem in adolescents, particularly in girls who experience more drastic changes in self-esteem than boys during this period.

Current Study

The purpose of this study was to collect cross-sectional data from adolescent girls in order to examine how self-esteem and self-reported sleep habits change over a critical period of adolescent development. It was hypothesized that (1) older girls would show less sleep, greater sleepiness, a phase preference for eveningness and a larger index of sleep irregularity between weekend and school week sleep than younger girls; (2) self-

esteem would be lower in girls with more advanced pubertal development; and (3) more pubertally advanced girls with insufficient sleep would have lower self-esteem than younger less developed girls and equally developed girls with better quality sleep.

Method

Participants

The sample consisted of 115 girls in grades 6, 7, and 8 (mean ages 12.09, 13.08, and 14.00 years, respectively) from The Girls' Middle School, Mountain View, CA (60% Caucasian). This was a convenience sample. Parents were provided with information about the study and consent was required for participation. Students whose parents gave consent were asked to provide assent prior to participation; ninety percent of the students participated in the study.

Design

This was a cross-sectional design that looked at between subject measures. Data were drawn from student volunteers who agreed to participate in a larger, longitudinal study that included a wide range of measures with regard to sleep, substance use, school performance, extracurricular activities, depression, self-esteem, and health status.

Instruments

Pubertal Development. Pubertal status was assessed using the Self-Administered Rating Scale for Pubertal Development (PDS) (Petersen, Crockett, Richards, & Boxer, 1988). This is a five item questionnaire that asks participants to rate, on a 1 – 4 scale (1= not started to 4= completed), how far along they believe their development is on specific physical domains (height growth spurt, body hair growth, skin changes, breast growth,

and menarche) associated with the transition into puberty. Responses to the PDS can be used to assess a mean puberty score, and can be used to estimate a derived Tanner stage. Reliability has been previously assessed by looking at internal consistency; alpha coefficients for each item range from .68 - .83 with a median of .77 for the 5 items (Petersen, Crockett, Richards, & Boxer, 1988). In a subsequent study Acebo & Carskadon (1993) assessed reliability of the scale by comparing student self ratings with reports from parents, teacher and physicians; correlations on each of the rated items was significant, $p < .001$. Mean puberty scores were calculated from the questions of body hair growth, breast development, and menarche. Derived Tanner stages were computed according to the Petersen et al. (1988) algorithm which was based on menarcheal status, breast development, and body hair growth. Puberty category scores were derived (from the PDS) by using combined scores from the questions of body hair growth and breast development (possible range 2-8) and the presence or absence of menarche as follows: Prepubertal = <3; Early Puberty = 3 and no menarche; Midpubertal = 4 and menarche; Late Puberty = 5-7 and menarche; Postpubertal = 8 and menarche. The five pubertal categories map onto derived Tanner stages I-V.

Sleep measures. Measures assessing the various sleep variables were taken from the School Sleep Habits Survey (Wolfson and Carskadon, 1998; (A. Wolfson et al., 2003) which is composed of 68 questions with a total of 148 items. This survey questions students about their sleep habits and waking behaviors, accidents and injuries, health, school performance and attendance, frequency of sleep-related behaviors and complaints,

and other issues. For this study the domains of interest from the all encompassing survey were sleepiness, sleep quality, general sleep habits and chronotype.

Sleepiness. The Sleepiness Scale is a 10 question scale used to determine the degree of sleepiness of a participant and asks questions about whether participants had struggled to stay awake in different situations over the past two-weeks. Scores on this scale range from 10 – 40; higher scores indicate a greater degree of sleepiness. Reliability has been measured with a Cronbach alpha coefficient of 0.63 in a normal adolescent population (Giannotta et al., 2002). For this sample the question about somnolence while driving was excluded based on irrelevance (girls at this age were not driving), making a total of 9 questions with a score range of 9-36.

Sleep Habits. General sleeping habits are assessed by calculating total sleep times (calculated from reported bed and wake-up times), and comparing bed time and rise time during the week with those times during the weekend. Schedule regularity is assessed by looking at weekend delay (difference between weekend bedtime and school-night bedtime) and weekend oversleep (difference between weekend total sleep time and school night total sleep time).

Chronotype. The Morningness/Eveningness Scale (Carskadon et al., 1993) is a 10 item scale assessing preference as a “night owl” or an “early bird”. Scores range from 10-43 with lowest scores indicating extreme eveningness and highest scores indicating extreme morningness. Cronbach’s alpha of 0.73 has been reported in a similar population, indicating good reliability (Giannotta et al., 2002).

Self-Esteem. Self-Esteem was assessed using the Rosenberg Self-Esteem Scale (Rosenberg, 1965). This is a 10 item measure with a 4 point (0-3) Likert-like scale rating from strongly agree to strongly disagree on statements that deal with general feelings about oneself (i.e. on the whole I am satisfied with myself). Items 2, 4, 6, 8 and 9 are reverse scored; scores are summed for a total score. Total scores range from 0-30 with lower scores being indicative of lower self esteem and higher scores being indicative of higher self esteem. Self-esteem includes a person's subjective appraisal of himself or herself as intrinsically positive or negative to some degree. Rosenberg (1979) summarizes the research on the scale's reliability and validity. Two small college samples had two-week test-retest reliability coefficients of $r = .85$ and $.88$. Along with face validity, the scale has also demonstrated convergent validity with the Coopersmith Self-Esteem Inventory, with the scales correlated at $r = .60$ (Robinson & Shaver, 1973). While there are no official cut-off scores, studies within in similar populations have adopted these general guideline for interpretation: high self-esteem is indicated by a score >25 , normal with a score 15-25, and low with a score <15 .

Setting and Apparatus

All questionnaires were presented as part of a larger single survey study to students on individual computers at The Girls Middle School, Mountain View, CA during a normal class period. Participants were given the entire 45 minute class period to complete the survey; however the entire survey took approximately 30 minutes to complete. The survey was web-based and hosted on a secure site by the school. Students logged into the survey using their school identification number (ID). and password. For

the purposes of data coding each student ID was assigned a unique 3-digit identifier to anonymize the data. The key relating student identity to the three letter code is known only to the school registrar who does not have access to the data. Teachers were available to provide technical support if necessary, and the researcher was present to provide answers to any study-related questions.

Procedures

Data were collected from all girls on one day in their regularly scheduled science class periods. Student participants were asked to provide assent and reminded that they had the right to withdraw their participation at any time. Participants were instructed to log into the survey website with their student ID and password, using their own laptop computers. Participants were instructed to answer each question as it came up, to the best of their knowledge. Once participants logged in they were presented with general instructions about the study, followed by the start of the survey with specific directions for each individual questionnaire. Participants were presented with 1-3 questions on the screen at a time, and required to respond to each question prior to progressing to the next page of questions; it was not possible to go back and change responses. All participants completed the survey on individual laptop computers that they were familiar with; a teacher was present to provide technical support if necessary.

Data Analysis

Analysis of the data is presented in four parts. The first set of analyses was conducted to examine whether self esteem and measures of sleep changed as a function of age. The second set of analyses examined the effect of critical sleep variables on self-

esteem after taking age into account. The third set of analyses examined whether pubertal status had an effect on self esteem and sleep above and beyond those accounted for by age. The final set of analyses explored the interaction between sleep, pubertal status and age on self-esteem in the adolescent girls in this sample.

Relationships between continuous variables were evaluated with Pearson's Bi-variate correlations and the impact of age on key variables was evaluated using standard linear regressions. The impact of pubertal status on sleep variables was evaluated using univariate analyses of variance (ANOVA), using the two pubertal status categories (pre- vs. post-menarcheal) with age as a covariate. The impact of pubertal status and perceived sleep quality on self-esteem was assessed by using a 2-factor ANOVA model: Pubertal status (pre- vs. post-menarcheal) and self-assessed sleeper type (good vs. poor sleeper), again with age as covariate. An alpha level of .05 was used for all statistical tests.. All data analyses were performed using SPSS version 16 for Windows. All variables were assessed for normality of distribution and outliers prior to analyses.

All variables used in analysis were assessed for normality of distribution and examined for outliers prior to analysis; cases that were at least 1.5 interquartile ranges away from the median of the sample were excluded from analysis with that variable. There was one outlier score for sleepiness, morningness/eveningness, and weekend sleep onset latency, two for school wake time, three for self-esteem and school bed time, five for school TST, weekend bedtime, weekend wake time, and weekend TST, and six outliers for weekend oversleep. One subject appeared as an outlier on multiple variables and is discussed in depth as a case study.

Based on the distribution of data in the sample there was an unequal representation across stages of pubertal development. There were 3 girls in the pre-pubertal category (Tanner stage I), 3 girls in the early pubertal category (Tanner stage II), 43 girls in the mid-puberty category (Tanner stage III), 59 girls in the late-puberty category (Tanner stage IV) and 5 in the post-puberty category (Tanner stage V). It was decided to split the sample into two categories based on pubertal status. Girls in the pre-, early-, and mid-puberty categories (Tanner stages I-III) share the common absence of menarche and have less physical developments and were included on the pre-menarcheal group. Girls in the late-, and post-puberty categories (Tanner stages IV-V) share the presence of menarche along with more advanced signs of physical development and were included in the post-menarcheal group.

Results

The participants in this study were 60% Caucasian, and had a mean age of 13.01 ($SD=.88$) with ages ranging from 11.5 to 14.5 years. As a whole, the average bedtime was 10:02 pm ($SD=42$ minutes) on school nights, and students got an average of 494 minutes (8.2 hours) of sleep on school nights ($SD=72$ minutes). On weekend nights the average bedtime was 10:45 pm ($SD=63$ minutes) and students slept longer on weekend nights than during the school week by an average 77 minutes ($SD=89$ minutes). Descriptive statistics for all variables are presented in Table 1, and are reported by grade level.

Table 1

Percentages, Means, and Standard Deviations of Self-Esteem, Demographic and Sleep Variables for a Sample of 115 Middle School Girls

	<i>n</i> =43 Grade 6 <i>M</i> (<i>SD</i>)	<i>n</i> =34 Grade 7 <i>M</i> (<i>SD</i>)	<i>n</i> =38 Grade 8 <i>M</i> (<i>SD</i>)	<i>n</i> =115 Total <i>M</i> (<i>SD</i>)
Rosenberg Self-Esteem (RSE)	32.53 ^a	31.24 ^b	27.95 ^{a,b}	30.55
Scale Range: 10-40	(5.52)	(5.52)	(5.23)	(5.57)
<i>Demographic Variables</i>				
Age (years old)	12.09 ^a (.40)	13.07 ^a (.35)	14.00 ^a (.32)	13.01 (.88)
Pubertal Status				
Pre-menarche	65% ^a	56% ^b	11% ^{a,b}	44%
Post-menarche	35%	44%	89%	56%
Ethnicity				
Caucasian	58%	77%	47%	60%
Latino/a	13%	3%	16%	11%
Asian-American	11%	13%	16%	13%
Other	18%	7%	22%	16%
<i>Sleep Variables</i>				
School Bedtime	21:36 ^a	21:59 ^a	22:34 ^a	22:02
(minutes)	(37)	(36)	(32)	(42)
School Wake Time	06:53	06:46	06:55	06:51
(minutes)	(23)	(36)	(30)	(30)
School TST	523 ^a	494	461 ^a	494
(minutes)	(59)	(72)	(71)	(72)
Weekend Bedtime	22:17 ^{a,b}	22:44 ^b	23:16 ^a	22:45
(minutes)	(54)	(68)	(55)	(63)
Weekend Wake Time	08:30 ^a	08:40	08:57 ^a	08:42
(minutes)	(66)	(65)	(85)	(73)
Weekend TST	589	571	544	569
(minutes)	(63)	(92)	(111)	(92)
Weekend Oversleep	66	77	88	77
(minutes)	(69)	(106)	(92)	(89)
Weekend Delay	41	57	56	51
(minutes)	(47)	(62)	(61)	(57)
Sleepiness	11.15 ^a	11.15 ^b	12.71 ^{a,b}	11.67
Scale Range: 9-36	(2.29)	(1.71)	(3.14)	(2.56)
Morningness/Eveningness	29.73 ^a	28.47	26.87 ^a	28.39
Scale Range: 10-43	(5.59)	(4.88)	(5.16)	(5.33)
Sleeper Type				
Good	83%	82%	71%	79%
<i>n</i>	34	28	28	90
Bad	17%	18%	28%	21%
<i>n</i>	7	6	11	24

n ranges from 110-115; "Other" in Ethnicity includes African American, Middle Eastern, Multi-racial, and unspecified; higher scores on RSE, Sleepiness, M/E = higher self-esteem, more sleepy, and preference for morningness. Means of variables with similar subscripts differed significantly from each other, $p < .05$

On average, sixth graders went to bed an hour earlier than eighth graders ($M=21:36$ and $22:34$, respectively), and woke up at a similar time, getting about an hour more of sleep ($M=8.7$ hours) than eighth graders ($M=7.7$ hours) and about half an hour more sleep than the seventh graders ($M=8.2$ hours) (Table 1). On weekend nights, all students went to bed about 45-minutes later and woke up about 1.5 hours later than on weekdays. As for during the week, bedtimes were progressively later with increasing grade. Wake times differed by, on average, 27 minutes between sixth grade ($M=8:30$) and eighth grade ($M=8:57$). Mean total sleep times on weekend nights varied by forty-five minutes between sixth and eighth graders, with sixth graders sleeping 9.8 hours, seventh graders sleeping 9.5 hours, and eighth graders sleeping 9.1 hours, on average.

Self-esteem, based in the Rosenberg Self Esteem Scale, decreased between sixth (32.5), seventh (31.2), and eighth grades (27.9) as did the morningness/eveningness (M/E) scores, indicating a tendency for evening phase preference with later grade (Table 1). The ratio of pubertal status reverses between sixth (65% pre-menarche) and eighth grade (89% post-menarche), which is consistent with the typical onset of menarche in girls. There is a decrease in the percentage of students who reported being good sleepers between sixth and eighth grade (83% vs. 71%), indicating that by eighth grade there were more students subjectively defining themselves as poor sleepers, compared to the sixth and seventh graders.

Correlations

Bi-variate Pearson's correlations between grade, derived Tanner stage, self-esteem, and sleep variables (school bedtime, school total sleep time(TST), weekend

bedtime, weekend wake time, weekend total sleep time, weekend delay, weekend oversleep, sleepiness, and M/E) are presented in Table 2.

Table 2
Pearson Correlation Coefficients for Key Variables

	2	3	4	5	6	7	8	9	10	11	12	13
1 Age	.91**	.44**	-.31**	.52**	-.44**	.34**	.24*	-0.16	0.12	0.15	.26**	-0.12
2 Grade		.42**	-.36**	.54**	-.42**	.37**	.23*	-.19*	0.09	0.12	.25**	-.23*
3 Pubertal Status			-.29**	.28**	-.29**	.33**	.19*	-0.15	0.17	0.09	0.15	-0.2*
4 Self-esteem				-.29**	.23*	-.29**	-.26**	0.12	-0.13	-0.13	-.27**	.23*
5 School Bedtime					-.75**	.68**	.37**	-.24*	0.13	0.14	.41**	-.32**
6 School TST						-.59**	-0.18	.36**	-0.1	-.24*	-.31**	0.17
7 Weekend Bedtime							.35**	-.46**	.66**	-.20*	.31**	-.35**
8 Weekend Waketime								.58**	0.18	.71**	.36**	-.55**
9 Weekend TST									-.41**	.70**	0.03	-0.16
10 Weekend Delay										-.36**	0.17	-.26**
11 Weekend Oversleep											0.19	-.24*
12 Sleepiness												-.37**
13 Morningness/Eveningness												

** Correlation is significant at the .01 level (2-tailed); * Correlation is significant at the .05 level (2-tailed); n ranges from 109-115

Higher self esteem was significantly correlated with being less physically developed ($r=-.29$), getting more sleep during the week ($r=-.23$), being less sleepy ($r=-.27$), and having a phase preference for morning ($r=.23$).

Sleep variables were significantly correlated with each other in expected directions such that the sleepier a participant rated herself the more likely she was to go to bed later on school nights ($r=.41$), get less total sleep during the week ($r=-.31$), and have a chronotypical preference for eveningness ($r=-.37$).

Age

To examine whether, in this sample, age had an effect on the variables of interest independent linear regressions were conducted; complete results are presented in Table 3. Age accounted for a significant proportion of variance in school bedtime ($R^2 = .27, F(1,107)=39.43, p<.001$), weekend bedtime ($R^2 = .11, F(1,107)=13.52, p<.001$), and school TST ($R^2 = .19, F(1,107)=25.68, p<.001$), indicating that as the girls got older they went to bed significantly later both during the week and on weekends, and that during the week they got significantly less total sleep than the younger girls. Age was also a significant predictor of weekend oversleep ($R^2 = .04, F(1,107)=4.05, p<.05$), and level of sleepiness during the day ($R^2 = .06, F(1,106)=6.54, p<.05$), indicating that older girls had a significantly larger difference between the total amount of time they slept during the week and the total amount of time that they slept during the weekend and that as the girls got older they also got sleepier. Self-esteem also changed significantly as a function of age ($R^2 = .11, F(1,106)=12.81, p<.001$), showing that as girls got older self-esteem decreased.

Table 3
Standard Linear Regressions of Self-Esteem and Sleep Variables with Age in a Sample of Middle School Girls

Variable	r	R ²	Beta	F	n
Self-Esteem	0.3	0.09	-0.3	11.06**	110
School Bedtime	0.52	0.27	0.52	39.43**	110
School TST	0.37	0.14	-0.37	17.34**	113
Weekend Bedtime	0.34	0.11	0.34	13.52**	108
Sleepiness	0.26	0.07	0.26	7.90**	113
Weekend Oversleep	0.15	0.02	0.15	2.45*	108
Morningness/Eveningness				n.s.	
Weekend TST				n.s.	
Weekend Delay				n.s.	
Weekend Waketime				n.s.	

*p<.05; **p<.01

The results of this set of analyses indicate that it is important to take age into account in any subsequent analyses with the sample, because it is possible that any changes or differences found might be due, in part, to getting older.

Sleep and Pubertal Status

To determine whether any of the key variables were impacted by pubertal status (pre-menarche vs. post-menarche), above and beyond the impact seen due to age, a series of univariate analyses of variance were conducted. There were no significant differences between pre-menarcheal and post-menarcheal girls on the sleep variables included in the analysis, above and beyond those accounted for by age.

Sleep and Self-Esteem

A hierarchical linear regression analysis was conducted to evaluate the degree to which sleep variables were predictive of self-esteem above and beyond that of age. To control for the effect of age it was entered into the first step of the analysis, and statistics

of change were examined. In step two, the continuous sleep variables (school TST, weekend oversleep, M/E, and sleepiness) were entered.

Results from the analysis are presented in Table 4. As expected age accounted for a significant amount of the variance in predicting self-esteem ($R^2=.09$, $F(1,108)=11.01$, $p<.01$). The contribution of the set of sleep variables significantly increased the amount of variance accounted for, $\Delta R^2=.09$, $F_{\text{change}}(4,104)=2.81$, $p<.05$, however, of all the sleep variables only school TST made a significant unique contribution to the variance, $\beta=.22$, $p<.05$. This indicates that the more sleep a student got the higher her self-esteem was, regardless of age.

Table 4

Summary of Hierarchical Regression Analysis for Variables Predicting Self-Esteem in a Sample of Middle School Girls

	r	β	ΔR^2	Fchange	Overall R2
Step 1: Controlling for Age					
Age	0.304	-0.3**	0.09	11.01**	0.09
Step 2: Sleep Variables	0.425		0.09	2.81**	0.18
Age		-0.17			
Morningness/Eveningness		0.16			
School TST		.22*			
Weekend Oversleep		0.09			
Sleepiness		-0.15			

n=110; * $p<.05$; ** $p<.01$

Sleep and Pubertal Status on Self-Esteem

A two way analysis of variance was conducted to evaluate the effect of pubertal status (pre- and post-menarche) and self-assessed sleeper type (good or bad sleeper) on self-esteem with age as a covariate. Even after controlling for age, there were significant main effects for both pubertal status ($F(1,107)=6.15$, $p=.02$) and sleeper type

($F(1,107)=4.85$, $p=.03$), indicating that self-esteem was significantly higher in pre-menarcheal girls ($M=31.9$) than post-menarcheal girls ($M=28.71$). Self-esteem also was significantly higher in those who consider themselves to be good sleepers ($M=31.65$) compared to those who consider themselves poor sleepers ($M=28.97$).

There was a significant interaction between sleeper type and pubertal status ($F(1,107)=4.3$, $p<.05$). In the group of pre-menarcheal girls both self-described good sleepers ($M=32.68$) and self-described poor sleepers ($M=32.17$) had similar levels of self-esteem, but in the post-menarche group the poor sleepers ($M=25.56$) showed a significant decrease in self-esteem when compared to the good sleepers ($M=30.82$). This interaction is illustrated in Figure 1.

Figure 1
Level of Self-Esteem for Self-Reported Good Sleepers and Poor Sleepers for Girls who are Pre-Menarcheal and Post-Menarcheal

Pre-menarcheal: good sleepers, n=41; poor sleepers, n=6
Post-menarcheal: good sleepers, n=45; poor sleepers, n=16

Case Study

In examining the data for outliers there was one particular subject (hereafter referred to as X) that seemed to occur repeatedly as an outlier on multiple variables; she makes an interesting case study to illustrate, an extreme example, of how sleep and mood can affect functioning in adolescent girls. Subject X is a post-menarcheal, eighth grade

Caucasian girl 13.6 years old who reported being in good health (Body Mass Index = 18) with no history of disability or ADHD.

Overall her perception is that she is a poor sleeper who is not getting enough sleep and who rarely gets even adequate sleep. In the two weeks prior to the survey she had not been satisfied with her sleep on any night and she only got one good night of sleep. During the day she reports that sleepiness is a very big problem for her, which was corroborated with a sleepiness score of 21 ($M=12.51$). Her score of 13 on the M/E scale indicates that she is an extreme “evening/owl” type.

During the school week she goes to bed much later (1am) than her classmates ($M=10:30pm$), reporting it takes her up to 70 minutes to fall asleep each night, she wakes up, by alarm clock, a bit later (7:15am) than her classmates ($M=6:51am$), and has an extremely short total amount of sleep (305 minutes). She reports not waking during the night and gets a ride to school with her parents. Her reason for going to bed during the week is that she has finished her homework. On the weekends she reports going to bed an hour earlier than during the week (11pm) and waking up four hours and forty-five minutes later than she does during the week. It takes her about an hour to fall asleep on the weekends, giving her a total sleep time on the weekends of 660 minutes ($M=575$ minutes). Her cue for going to bed on the weekend is when she has finished socializing, and she allows herself to wake up without an alarm clock.

Her level of emotional and mood functioning seems to reflect the extremely poor quantity and quality of sleep that she reports. She had an extremely low level of self esteem (11, $M=28$), and her score on the depressed mood scale was within the clinical

range for depression. Subject X illustrates how pubertal status combined with extremely poor sleep and poor psychosocial functioning can relate to diminished daytime functioning.

Discussion

As expected, self-reported sleep behavior changed dramatically across the three years of middle school. Age was an important factor in explaining these differences. Older girls went to bed later, had less sleep, and were sleepier during the day. Sleep behavior was, however, unrelated to pubertal status indicating that age, or perhaps grade level, is the major determinant of sleep changes in adolescent girls. Grade level offers a possible alternate explanation for the differences seen across age in this sample. Age was strongly correlated with grade level but grade level has an added social aspect to it. Girls at progressing grade levels are presented with a larger workload, higher expectations for success, and more responsibilities in their academic, social and familial lives which likely have an effect on their sleep and daily functioning. Changes in self-esteem were impacted by age, with older girls showing lower levels of self-esteem than younger girls. Total sleep time was also related to self-esteem, regardless of age, with girls who slept less reporting lower levels of self-esteem. Most importantly, a decline in self-esteem after menarche was strongly related to sleep quality. Post-menarcheal girls who were self-reported poor sleepers had lower self-esteem levels than those who self-rated as good sleepers. This effect might be explained by a tendency to rate all aspects of behavior poorly if self-esteem is low. However, before the onset of menarche poor sleepers and good sleepers had similar levels of self-esteem. These findings suggest that sleep

behavior and self-esteem are closely associated in adolescent girls regardless of age and that sleep quality becomes an important factor after menarche in influencing levels of self-esteem.

Age and Sleep

Results from the present study support previous findings in the literature which report changes in sleep-wake patterns across adolescence. Across middle school grades, girls went to bed later and showed a shift in chronotype preference from more morning type to more evening type. Shifting bedtimes with age are thought to be caused in part by biological and circadian shifts (Crowley, Acebo, Carskaddon, 2006), increasing social activities and changes in responsibilities such as increased workloads and demands with school (Allen, 1992). In our sample school start time remained constant across the sample (leading to consistent school day wake times), which, paired with later bedtimes led to a decrease in weekday total sleep time. This decrease in total sleep time led to increased levels of sleepiness during the day across grades.

As per previous reports (Carskadon, 1990; Strauch & Meier, 1988; Wolfson & Carskadon, 1998) girls slept longer on the weekends than during the week, probably a sign of their attempt to catch-up on accrued sleep loss from during the week. However, as with the week day data, weekend bedtimes and wake times both shifted later with age. Carskadon et al. (1980) reported that despite the shift towards later bedtimes across adolescence, sleep need does not decline with age, instead optimal sleep time for adolescents, 11-16-year olds, remains constant at approximately 9.2 hours. On average our sample got 8.5 hours which was about an hour less than the reported need, except on

weekends (where they got more), indicating that they may be in a continuous cycle of sleep debt and sleep catch-up that will never even out, putting them at risk for chronic insufficient sleep. The discrepancy between weekday and weekend sleep was greatest for 8th graders, who also showed the greatest level of daytime sleepiness. Total amounts of sleep, and bedtimes, both during the week and on the weekends, reported by girls in the present study were similar to those reported for similarly aged American samples (Carskadon, 1990), yet differed on sleep habits from reports of international samples (Giannotti et al., 2002; Andrade et al., 1993; Yang et al., 2005; LaBerge et al., 2001; Gau & Soong, 2003). It has been suggested that most differences seen between American samples and samples from other countries can be attributed to cultural differences both at the societal and academic level (Yang et al., 2005).

While overall levels of sleepiness reported in the present study are well below clinical levels reported in people with apnea or narcolepsy, it is important to note the significant increase in level of sleepiness reported between 7th and 8th grade students. This increase in subjective sleepiness with age is consistent with previously published longitudinal findings (Campbell et al., 2007) that show consistent, non-significant, increases in sleepiness between ages 8-12 and then a robust, yet steady, increase in sleepiness between 12 and 15. Carskadon et al. (1980) conducted laboratory studies using objective measures of sleepiness (Multiple Sleep Latency Test, MSLT) and found that adolescents were sleepier during the day than preadolescents attributing this difference to pubertal development based on Tanner Stage. Our results provide support

for an age-related influence on subjective sleepiness but not for an effect of pubertal status above this.

Studies that examine chronotypic preference tend to focus on comparisons between participants in extreme groups on either end of the continuum and focus less on the mean scores of the morningness/eveningness (M/E) questionnaire. Results from the present study are consistent with previous reports (Russo et al., 2007; Giannotti et al., 2002; Carskaddon et al., 1993), showing chronotype preference shifted with age resulting in older girls having a stronger evening preference. Russo et al. (2007) reported similar mean M/E scores in a large sample of Italian adolescents (8-14yrs), and indicated a clear significant drop in scores (indicating eveningness) between 12 and 13 years of age.

In a study of 14-year-old teens Mercer et al. (1999) found that despite getting similar total amounts of sleep, teens who reported that they felt they were not getting enough sleep reported needing more sleep, having more signs of daytime sleepiness and a stronger chronotypic preference for eveningness. Scores on the M/E scale were similar to those found in the present study. In the current study 8th grade girls had significantly stronger preference for eveningness than 6th graders which could be a factor related to the increase in sleepiness and the lower level of perceived good sleepers seen in the 8th grade girls. Our results support the suggestion that perceived sleep quality may be more important in predicting daytime functioning than actual quantity of sleep.

Puberty and Sleep

Objective measures of sleep in longitudinally designed, laboratory based studies have looked at whether sleep changes in adolescence are due to pubertal maturation or

whether they are driven by age. Separate studies from Feinberg and Campbell (Campbell & Feinberg, 2009; Feinberg et al., 2006) provide support for objective changes in sleep EEG being linked to age and not pubertal stage, while Carskadon et al., (1993) presents results supporting a link between objectively measured daytime sleepiness and pubertal maturation. Results, thus far have been inconclusive, however there do seem to be systematic differences in conclusions based on the types of procedures used and the outcomes being measured. Because puberty and age are typically correlated with each other it can be difficult to tease apart what is age-based and what is puberty-based and different groups utilize different methods to do this. The present study utilized a method of statistical control by employing age as a covariate in our analyses. Generally speaking, differences across the sample in more objective (but still self-reported) measures of sleep, such as bedtimes, wake times, and total sleep time in our study were better explained by age than pubertal development. However, perceived sleep quality had significant pubertal development effects above and beyond what was accounted for by age.

In contrast to our findings, another survey based study by Laberge (2001) reported significant differences between pubertal categories on weekend wake time, weekend time in bed, wake time shift, and weekend oversleep in a sample of 13 year olds. Important differences between that study and ours include that their pubertal data was based on parent-reported pubertal rating, and that they combined data from both boys and girls. Their pubertal data encompassed all five developmental Tanner stages (Marshall & Tanner, 1969) but their sample was confounded by the different

developmental trajectories that exist for boys and girls. Given that girls show signs of maturation at an earlier age than boys, it is possible there could have been a gender bias with their results. Another possible reason for differences between the two studies is the collapsing of pubertal development into a dichotomous variable in the present study due to the lack of equal representation in all pubertal stages. Finally, the Laberge (2001) study used parent rating of physical development and sleep habits which may be less accurate than adolescent self-report (Owens et al., 2000).

Self-Esteem and Sleep

During the period of adolescence levels of self-esteem have been found to differentially decrease between boys and girls, with girls experiencing more substantial declines than boys (Angold, 1999; Kling et al., 1999; Rosenberg & Simmons, 1975). The exact timing of and the reason for the decline in self-esteem is not completely understood but it is thought to partially be related to changes that occur with getting older (Brown et al., 1998; Robins, Trzesniewski, Tracy, Gosling, & Potter, 2002) or with the onset of puberty (Robins et al., 2002; Harter, 1990).

Few studies exist that have investigated changes in self-esteem in association with sleep behavior across adolescence with which to compare our results. Similar to our findings, Fredriksen et al (2004) found that declines in self-esteem were associated with declines in sleep time. It is difficult to determine whether less sleep leads to lower self-esteem, whether it is lower levels of self-esteem that lead to decreased sleep, or whether a third factor is responsible for both changes. Mood related variables, such as self-esteem, have a bidirectional relationship with sleep. For example, depressed mood can lead to

poor sleep quality (Dahl, 1999) and poor sleep quality can lead to depressed mood (Breslau et al., 1996). There are also obvious examples of a third factor such as chronic pain being responsible for both mood and sleep changes (Fishbain et al., 1997).

Due to the correlational nature of the present study it was not possible to determine the direction of causation between sleep and self-esteem. Fredriksen et al. (2004), however, with a longitudinally designed study used cross-domain modeling for analysis which allowed them to test a model of an alternative theory with post-hoc testing. They found,

“barring a single bidirectional pathway (between depression and sleep) the direction of influence between sleep and outcome variables (self-esteem) was largely unidirectional ... this challenges the argument that the outcome variables (self-esteem) were, in fact, responsible for the changes in sleep.” (p. 92)

The present results provide support for there being a relationship between sleep and self-esteem in adolescent girls who are already at higher risk, compared to boys, for emerging from adolescence with lower levels of self-esteem. If poor levels of sleep add to that risk it may be an area worth investing energy as a way to prevent against the increased risk or to bolster sleep in order to serve as a potential buffer against lowered self-esteem.

While Fredriksen et al. (2004) did not investigate a role of puberty in changes in self-esteem or in the relationship between sleep time and self-esteem, research has shown that self-esteem can decline with increasing pubertal status, primarily in girls. Our findings provide evidence that this decline in self-esteem across puberty is also influenced by sleep quality (Angold, 1999). This supports a hypothesis of the study that

aspects of sleep and pubertal maturation affect self-esteem in adolescent girls. As girls progress through puberty they experience many changes, biological, physical, social, and sleep related; those girls who are unable to adapt or who cope poorly with these changes, experience even lower levels of self-esteem. Our findings indicate that poor sleep may compound the effect of these changes on self-esteem. The fact that there were self-described poor sleepers in both the pre- and post-menarcheal groups, and that pre-menarcheal poor sleepers did not indicate a difference in self-esteem from the good sleeper, indicates that there is something particular to the onset of menses that initiates the resulting decline in self-esteem. With cross-sectional data it is not possible to look at trajectories of change within the same person, or group of people, to see how an event may alter other variables only longitudinal studies will help elucidate this further.

Insights from a Case Study

Results from Fredriksen et al. (2004) are able to shed some light onto the possible causal pathways that may be at work with Subject X. Sleep problems are a common complaint in depressive patients and depressed patients show objectively and subjectively poor sleep (Tsuno et al., 2005). Results support previous findings (Fredriksen et al., 2004) that there is a bidirectional pathway between depressive symptoms and sleep and that there is a unidirectional pathway between sleep and self-esteem, with quality of sleep leading to level of self-esteem. It is possible that for Subject X depressive symptoms may have preceded any disturbances in sleep, but the changes in sleep that normally take place during adolescence were likely exacerbated by the depressive symptoms. Her strong tendency as a “night owl” combined with the regulated school start time resulted

in a diminished window of sleep opportunity which was cut even shorter by her difficulties falling asleep. Evidenced by the extreme irregularity in her school vs. weekend sleep times she recognizes that she is not getting enough sleep during the week and tries to compensate on the weekends where she lets herself sleep until she naturally wakes up. Unfortunately this attempt at “catch-up” is not sufficient to alleviate the damage done during the week. Her poor image of herself and her abilities, marked by extremely low self-esteem, is possibly fueled by her poor grades and which may be a result of sleepiness during the day that makes it difficult to concentrate. All of these negative outcomes are sure to influence her interactions with others as well. By knowing that poor sleep is a potential pre-cursor to low self-esteem, focusing on ways to improve sleep quality and quantity for Subject X may improve the problems she is experiencing in her daily functioning.

Limitations and Future Studies

The present study collected data from girls attending middle school in a single sex educational environment. This provided the opportunity to examine sleep habits and self-esteem in an environment where, the sometimes negative impact, of the same-aged opposite sex was not present (Caspi, Lynam, Moffitt, 1993), it also means that the results of this study may not be completely generalizable to the girls in co-educational environments. By only looking at girls in an all-girls school it is possible that there were social aspects that are different than those that effect similarly aged girls in a co-educational environment which would bring us to different conclusions/results. A next step would be to collect complimentary data from similarly aged girls in a co-educational

environment and compare to see if differences between the samples exist. This study represented the range of demographics present at the school but was not necessarily representative of the demographics of the larger community.

The use of survey methods to collect data about sleep from adolescents has been used extensively by many different groups, and has been validated for accuracy with the use of more objective measures of sleep, such as actigraphy. Despite this, one potential limitation to this is the retrospective reporting required by the student participants and the degree of accuracy that they are able to recall. Students were asked to respond to questions about “typical” sleep behavior over the last two weeks, a task which may be made more difficult if the student had something unusual occur within the two weeks prior to the survey (the survey date was scheduled so that it did not occur after a substantial break from school, i.e.: summer, spring or winter break). For future survey based studies it may be beneficial to have students complete a two week sleep diary prior to completing the survey to try and insure as accurate of results as possible, especially for the more objective type of questions (bedtime, wake time, and total sleep times). This would make it possible to validate the responses provided in the survey with the daily recordings as well.

Pubertal development was a key variable in the study and one limitation is that this sample did not provide sufficient representation across Tanner stages to allow for discrimination between stages of development. This may be due to the sample size or possibly due to the fact that by middle school (ages 11-14) most girls have already begun to show physical signs of pubertal development, leaving with a sample skewed towards

more matured adolescents. Another potential limitation in this study is the measurement of pubertal development; the measure used, while reliable and validated with similar samples, is a measure of physical development associated with changes in hormonal production in puberty as opposed to a direct measure of hormone level changes.

Hormonal assessment, however, was not feasible given the design of this study (survey-based) but is something to keep in mind for future studies that may allow for it.

With regard to pubertal development, one further limitation was that for the girls in our study who were post-menarcheal we did not control, or measure, where they were in their menstrual cycle at the time of the survey. Research suggests that in a period of about six days around the start of menstruation reported levels of subjective sleep quality are the lowest (Baker & Driver, 2006) in women. Implications of this in this sample are that if a significant proportion of the girls were within a few days of starting their periods it is possible that it had an effect on their responses to questions about sleep, and possibly mood. It is unlikely that all post-menarcheal girls were menstruating at the same time the survey was administered but it is something that is worth including in future studies.

Preliminary investigations of ethnic differences showed that pubertal status was related to a decline in self-esteem that was more pronounced in Caucasian girls than in non-white girls. However, due to insufficient numbers of participants in each ethnic group it is not possible to evaluate how pubertal status relates to self-esteem in each group. It has been reported that girls in different ethnic groups, specifically Hispanic and African American, do not interpret the increase in body mass index (BMI) that accompanies puberty as negative (Parker, et al., 1995). With this in mind we looked at

the relationship of BMI and self-esteem among the Latina girls in our sample and found that there was a significant negative correlation between BMI and self-esteem, even stronger than that for Caucasians alone. The sizes of our subsample's were not sufficient to make any generalizations to the population, but it appears that for the Latinas in our sample larger body size is associated with lower self-esteem. Future studies should investigate the role of BMI in predicting self-esteem in adolescent girls.

The cross-sectional design of this study allowed for comparison of girls of different ages and pubertal status, however, it did not allow any opportunity for determining causal pathways on the interactions that we found. Future longitudinal studies will allow for changes in sleep habits and self-esteem in individuals to be looked at and tracked with age and with pubertal development. Longitudinally, it will be possible to track pubertal changes and look at the timing associated with the subsequent alterations in sleep behavior and how girls images of herself change across time. Given that we found that perception of how one sleeps is an important factor in determining self-esteem (more important than actual time slept), one possible extension of this research will be to look at girls' perceptions of the timing of their pubertal development compared to just their pubertal development. This would involve looking at the onset of pubertal timing in an individual compared to her group of peers (early maturer vs. late bloomer) and seeing if her perception of pubertal timing is a salient predictor of her self-esteem level. This would further examine the social impact of pubertal development on psychological well-being.

Conclusion

The main goal of this study was to shed some light on the relationship between sleep and pubertal maturation on self-esteem in adolescent girls. Our results provide support for there being a relationship between sleep and affect in adolescent girls by showing how insufficient sleep can lead to negative psychosocial outcomes and how pubertal status can put girls at increased risk for negative outcomes, such as low self-esteem. This finding points to the possibility of sleep as a potential intervention for improving self-esteem in post-menarcheal girls. By targeting post-menarcheal girls who consider themselves poor sleepers and implementing a sleep improvement routine (or educational program) aimed at enhancing their quality of sleep it may result in a boost to their self-esteem.

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APPENDIX A. Sample Survey

The Girls' Middle School Sleep Survey

School Sleep Habits Survey

Instruction box:

Please answer the following questions as accurately and honestly as you can. There are no right or wrong answers.

*Do not spend too much time on any one answer. Your first impression is usually best.

*Answer each question in the order that it appears, you will not be able to go back and check your answers.

1. Today's Date: (MM/DD/YYYY)

2. Birth Date:

3. How old are you?

4. What time is it now?: _____ AM or PM

5. (5) What is your height? _____ feet _____ inches

6. (6) What is your weight? _____ pounds

7. (8) What grade are you in?

6

7

8

8. (9) What best describes your racial/ethnic background?

White/Caucasian

Black/African American

Hispanic/Latino

Asian/Asian American

Native American/Amerindian

Multiracial (please specify) _____

Other (please specify) _____

9. (10) In the last two weeks, have you slept in the same bed?

Every night

Almost every night

A few nights

Not at all

10. (14) Are your grades in school mostly:

Exemplary

Exemplary and Competent

Competent

Competent and Emergent

Emergent
 Emergent and Needs Additional Support
 Needs Additional Support

11. (15) What is the highest grade in school you expect to complete? (choose one)
 May not finish high school
 Will finish high school
 Will get a college degree
 Will get a degree beyond college
12. (16) Do you have any physical disabilities or chronic illnesses (for example, asthma, diabetes, deafness, loss of the use of a limb, etc)?
 Yes
 No
 If Yes, please specify: _____
13. (17) Compared to other people your age would you say that your health is:
 Poor
 Fair
 Good
 Excellent
14. (18) Do you have attention deficit hyperactivity disorder (ADHD) or a learning disability?
 Yes
 No
15. (19) Do you take Ritalin or some other medication to help you with concentration or a learning problem?
 Yes
 No
16. (21) During the last two weeks, how many days did you stay home from school because you were: (If you were NOT absent put 0)
 a. sick? _____ (0-10)
 b. other? _____ (0-10)
 Why did you stay home from school? _____

Instruction box:

There are no right or wrong answers. Be careful to choose the **one** answer that **best** describes the way your sleep has been in the last two school weeks.

The next set of questions has to do with your usual schedule on days when you have school.

17. (22) What time do you usually go to bed on school days?

List ONE time, not a range.

_____ AM or PM

18. (23) There are many reasons for doing things at one time or another. What is the main reason you usually go to bed at this time on school days? (select one)

My parents have set my bedtime

I feel sleepy

I finish my homework

My TV shows are over

My brother(s) or sister(s) go to bed then

I finish socializing

I get home from my job

Other: _____

19. (24) What time do you usually wake up on school days?

List ONE time, not a range.

_____ AM or PM

20. (25) What is the main reason you usually wake up at this time on school days? (choose one)

Noises or my pet wakes me up

My alarm clock wakes me up

My parents or other family members wake me up

I need to go to the bathroom

I don't know, I just wake up

Other: _____

21. (28) Figure out how long you usually sleep on a normal school night and fill it in here (Do not include time you spend awake in bed. Remember to include hours and minutes, even if minutes are zero.)

_____ hours _____ minutes

22. (29) On school days after you go to bed at night, about how long does it usually take you to fall asleep?

_____ minutes

23. (26) What time do you usually leave home on school days?

List ONE time, not a range.

_____ AM or PM

24. (27) How do you usually get to school?

Walk/ride bike
 Use public transit (bus, train, light rail, etc.)
 Get a ride with only your parent
 Carpool

Instruction box:

The next set of questions has to do with your usual schedule on days when you do not have school, such as on the weekends.

25. (30) What time do you usually go to bed on the weekends?

List ONE time, not a range.

_____ AM or PM

26. (31) There are many reasons for doing things at one time or another. What is the main reason you usually go to bed at this time on weekends? (select one)

My parents have set my bedtime

I feel sleepy

I finish my homework

My TV shows are over

My brother(s) or sister(s) go to bed then

I finish socializing

I get home from my job

Other: _____

27. (32) What time do you usually wake up on weekends?

List ONE time, not a range.

_____ AM or PM

28. (33) What is the main reason you usually wake up at this time on weekends? (choose one)

Noises or my pet wakes me up

My alarm clock wakes me up

My parents or other family members wake me up

I need to go to the bathroom

I don't know, I just wake up

Other: _____

29. (34) Figure out how long you usually sleep on a night when you do not have school the next day (such as a weekend night) and fill it in here (Do not include time you spend awake in bed. Remember to include hours and minutes, even if minutes are zero.)

_____ hours _____ minutes

30. (35) On weekends, after you go to bed at night, about how long does it take you to fall asleep?

_____ minutes

31. (36) Some people wake up during the night. Others never do. How many times do you usually wake up at night?

- Never
- Once
- 2 or 3 times
- More than 3 times
- I have no idea

32. (37) People sometimes feel sleepy during the daytime. During your daytime activities, how much of a problem do you have with sleepiness (feeling sleepy, struggling to stay awake)?

- No problem at all
- A little problem
- More than a little problem
- A big problem
- A very big problem

33. (38) Some people take naps in the daytime every day, others never do. When do you nap? (mark all that apply.)

- I never nap.
- I sometimes nap on school days.
- I sometimes nap on weekends.
- I never nap unless I'm sick.

34. (39) Can you figure out how much sleep you need? Fill out below how much sleep you think you would need each night to feel your best every day. (Remember to mark hours and minutes, even if minutes are zero.)

_____ hours _____ minutes

35. (40) In general, do you feel you usually get ...

- Too much sleep?
- Enough sleep?
- Too little sleep?

36. (41) Do you consider yourself to be ...

- A good sleeper?
- A poor sleeper?

37. (42) How often do you think you get enough sleep?

- Always
- Usually
- Sometimes

Rarely
Never

Instruction box:

Questions 38-41 are about things that have happened in the last two weeks.

38. (43) During the last two weeks, have you struggled to stay awake (fought sleep) or fallen asleep in the following situations? (Mark one answer for every item.)

- a. During the last two weeks, have you struggled to stay awake (fought sleep) or fallen asleep **in a face-to-face conversation with another person**?
Both struggled to stay awake and fallen asleep
Fallen Asleep
Struggled to stay awake
No
- b. During the last two weeks, have you struggled to stay awake (fought sleep) or fallen asleep travelling **in a bus, train, plane or car**?
Both struggled to stay awake and fallen asleep
Fallen Asleep
Struggled to stay awake
No
- c. During the last two weeks, have you struggled to stay awake (fought sleep) or fallen asleep **attending a performance (movie, concert, play)**?
Both struggled to stay awake and fallen asleep
Fallen Asleep
Struggled to stay awake
No
- d. During the last two weeks, have you struggled to stay awake (fought sleep) or fallen asleep **watching television or listening to the radio or stereo (ipod)**?
Both struggled to stay awake and fallen asleep
Fallen Asleep
Struggled to stay awake
No
- e. During the last two weeks, have you struggled to stay awake (fought sleep) or fallen asleep **reading, studying or doing homework**?
Both struggled to stay awake and fallen asleep
Fallen Asleep

Struggled to stay awake

No

- f. During the last two weeks, have you struggled to stay awake (fought sleep) or fallen asleep **during a test**?

Both struggled to stay awake and fallen asleep

Fallen Asleep

Struggled to stay awake

No

- g. During the last two weeks, have you struggled to stay awake (fought sleep) or fallen asleep **in a class at school**?

Both struggled to stay awake and fallen asleep

Fallen Asleep

Struggled to stay awake

No

- h. During the last two weeks, have you struggled to stay awake (fought sleep) or fallen asleep **while doing work on a computer or a typewriter**?

Both struggled to stay awake and fallen asleep

Fallen Asleep

Struggled to stay awake

No

- i. During the last two weeks, have you struggled to stay awake (fought sleep) or fallen asleep **playing video games**?

Both struggled to stay awake and fallen asleep

Fallen Asleep

Struggled to stay awake

No

39. (44) During the last two weeks, how often did you do the following? (Mark one answer for every item.)

- a. During the last two weeks, how often did you **drink soda with caffeine (like Coke, Pepsi; not like root beer, orange soda or Sprite)**?

Every day

Several times a week

Once or twice a week

Never

- b. During the last two weeks, how often did you **drink coffee or tea with caffeine**?

Every day
 Several times a week
 Once or twice a week
 Never

- c. During the last two weeks, how often did you **use tobacco (cigarettes, cigar, chewing, tobacco, etc)?**

Every day
 Several times a week
 Once or twice a week
 Never

- d. During the last two weeks, how often did you **drink alcohol (beer, wine, liquor)?**

Every day
 Several times a week
 Once or twice a week
 Never

- e. During the last two weeks, how often did you **use drugs (like marijuana, cocaine)?**

Every day
 Several times a week
 Once or twice a week
 Never

Please specify type: _____

40. (45) In the last two weeks, how often have you done the following?(Mark one answer for every item.)

Never
 Once
 Twice
 Several times
 Everyday/night

- a. In the last two weeks, how often have you **felt satisfied with your sleep?**

Never
 Once
 Twice
 Several times
 Everyday/night

- b. In the last two weeks, how often have you **arrived late to call because you overslept?**

Never

Once
Twice
Several times
Everday/night

- c. In the last two weeks, how often have you **fallen asleep in a morning class?**

Never
Once
Twice
Several times
Everday/night

- d. In the last two weeks, how often have you **fallen asleep in an afternoon class?**

Never
Once
Twice
Several times
Everday/night

- e. In the last two weeks, how often have you **awakened too early in the morning and couldn't get back to sleep?**

Never
Once
Twice
Several times
Everday/night

- f. In the last two weeks, how often have you **stayed up until at least 3 a.m.?**

Never
Once
Twice
Several times
Everday/night

- g. In the last two weeks, how often have you **stayed up all night?**

Never
Once
Twice
Several times
Everday/night

- h. In the last two weeks, how often have you **slept in past noon?**

Never

Once
Twice
Several times
Everday/night

- i. In the last two weeks, how often have you **felt tired, dragged out, or sleepy during the day?**
Never
Once
Twice
Several times
Everday/night
- j. In the last two weeks, how often have you **needed more than one reminder to get up in the morning?**
Never
Once
Twice
Several times
Everday/night
- k. In the last two weeks, how often have you **had an extremely hard time falling asleep?**
Never
Once
Twice
Several times
Everday/night
- l. In the last two weeks, how often have you **had nightmares or bad dreams during the night?**
Never
Once
Twice
Several times
Everday/night
- m. In the last two weeks, how often have you **gone to bed because you just could not stay awake any longer?**
Never
Once
Twice
Several times
Everday/night

- n. In the last two weeks, how often have you **done dangerous things without thinking?**
Never
Once
Twice
Several times
Everday/night
- o. In the last two weeks, how often have you **had a good night's sleep?**
Never
Once
Twice
Several times
Everday/night

41. (46) During the last two weeks, how often were you bothered or troubled by the following? (Mark one answer for every item.)

- Much
Somewhat
Not at all
- a. During the last two weeks, how often were you bothered or troubled by **feeling too tired to do things?**
Much
Somewhat
Not at all
- b. During the last two weeks, how often were you bothered or troubled by **having trouble going to sleep or staying asleep?**
Much
Somewhat
Not at all
- c. During the last two weeks, how often were you bothered or troubled by **feeling unhappy, sad, or depressed?**
Much
Somewhat
Not at all
- d. During the last two weeks, how often were you bothered or troubled by **feeling hopeless about the future?**
Much

Somewhat
Not at all

- e. During the last two weeks, how often were you bothered or troubled by **feeling nervous or tense?**

Much
Somewhat
Not at all

- f. During the last two weeks, how often were you bothered or troubled by **worrying too much about things?**

Much
Somewhat
Not at all

Instruction box:

Questions 42-51 have to do with how you might organize the timing of various activities if you were free to plan your day according to when you feel your best. Please answer the questions based on your body's "feeling best" times.

42. (47) Imagine: School is cancelled tomorrow! You can get up whenever you want to. When would you get out of bed? Between: (*Pick the time range closest to your ideal)

5:00 and 6:30am
6:30 and 7:45am
7:45 and 9:45am
9:45 and 11:00am
11:00am and noon

43. (48) Is it easy for you to get up in the morning?

No way!
Sort of.
Pretty easy.
It's a cinch!

44. (49) Gym class is set for 7:00 in the morning. How do you think you'll do?

My best!
Okay.
Worse than usual.
Awful!

45. (50) The bad news: You have to take a two-hour test. The good news: You can take it when you think you'll do your best. What time is that? (*Pick the time range closest to your ideal)

8:00 to 10:00am

11:00am to 1:00pm

3:00pm to 5:00pm

7:00pm to 9:00pm

46. (51) When do you have the most energy to do your work?

Morning! I am tired in the evening.

Morning more than evening.

Evening more than morning.

Evening! I am tired in the morning.

47. (52) Your parents have decided to let you set your own bedtime. What time would you pick? Between: (*Pick the time range closest to your ideal)

8:00 and 9:00pm

9:00 and 10:15pm

10:15pm and 12:30am

12:30am and 1:45am

1:45am and 3:00am

48. (53) How alert are you in the first half hour you're up?

Out of it.

A little dazed.

Okay.

Ready to take on the world.

49. (54) When does your body start to tell you it's time for bed (even if you ignore it)? Between:

8:00 and 9:00pm

9:00 and 10:15pm

10:15pm and 12:30am

12:30am and 1:45am

1:45am and 3:00am

50. (55) Say you had to get up at 6:00am, every morning: What would it be like?

Awful!

Not so great.

Okay (if I have to).

Fine, no problem!

51. (56) When you wake up in the morning how long does it take for you to be totally "with it"?

0 to 10 minutes

11 to 20 minutes

21 to 40 minutes

More than 40 minutes

Instruction box: (from S-ARSPD)

The next questions are about changes that may be happening to your body. These changes normally happen to different young people at different ages. Since they may have something to do with your sleep patterns, do your best to answer carefully. If you do not understand a question or do not know the answer, just mark "I don't know."

52. (57) (Puberty 1) Would you say that your growth in height:

- has not begun to spurt (1)
- has barely started (2)
- is definitely underway (3)
- seems completed (4)

53. (58) (Puberty 2) And how about the growth of your body hair? ("Body hair" means hair any place other than your head, such as under your arms.)

- has not begun to grow (1)
- has barely started to grow (2)
- is definitely underway (3)
- seems completed (4)

54. (Puberty 3) Have you noticed any skin changes, especially pimples?

- skin has not yet started changing (1)
- skin has barely started changing (2)
- skin changes are definitely underway (3)
- skin changes seem complete (4)

55. (Puberty 4) Have you noticed that your breasts have begun to grow?

- have not yet started growing (1)
- have barely started growing (2)
- breast growth is definitely underway (3)
- breast growth seems complete (4)

56. (Puberty 5a) Have you begun to menstruate (started to have your period)?

- yes (4)
- no (1)

<If no go directly to #58>

57. (Puberty 5b) If yes, how old were you when you started to menstruate?
age in years: _____

58. (61) During the last week, did you participate in any organized sports or extracurricular activities? (For example, committees, clubs, volunteer work, musical groups, church groups, etc.)

Yes

No (If no skip to number 59.)

Name all activities _____

How many **days** did you participate in any of your activities at the following times? (Account for all days you had an activity)

in the morning before school0 1 2 3 4 5

in the afternoon after school0 1 2 3 4 5

in the evening on days that you have school0 1 2 3 4 5

on the weekends 0 1 2

How many hours did you participate in all activities during the past 7 days?

during school week: _____ hours

during the weekends: _____ hours

During the last two weeks, have you struggled to stay awake (fought sleep) or fallen asleep during this participation?

no

struggled to stay awake

fallen asleep

struggled to stay awake and fallen asleep

If you did not have your organized activity or sport, would you go to bed:

earlier than you do.

the same as you do.

later than you do.

If you did not have your organized activity or sport, would you wake up:

earlier than you do.

the same as you do.

later than you do.

59. (62) During the last week, did you study/do homework?

Yes

No (If no, skip to number 60)

How many days did you study at the following times?

in the morning before school0 1 2 3 4 5

in the afternoon after school0 1 2 3 4 5

in the evening on days that you have school0 1 2 3 4 5

on the weekends0 1 2

How many hours did you study during the last 7 days?

during the school week: _____ hours

during the weekends: _____ hours

During the last two weeks, have you struggled to stay awake (fought sleep) or fallen asleep during studying?

no

struggled to stay awake

fallen asleep

struggled to stay awake and fallen asleep

If you did not have your homework, would you go to bed:

earlier than you do.

the same as you do.

later than you do.

If you did not have your homework, would you wake up:

earlier than you do.

the same as you do.

later than you do.

60. Below is a list of statements dealing with general feelings a person can have about herself. Please decide if you strongly agree, agree, disagree, or strongly disagree with the statement pertaining to you.

I feel that I am a person of worth, at least on an equal plane with others.

Strongly Agree

Agree

Disagree

Strongly Disagree

I feel that I have a number of good qualities.

Strongly Agree

Agree

Disagree

Strongly Disagree

All in all, I am inclined to feel that I am a failure.

Strongly Agree

Agree

Disagree

Strongly Disagree

I am able to do things as well as most other people.

Strongly Agree
Agree
Disagree
Strongly Disagree

I feel I do not have much to be proud of.

Strongly Agree
Agree
Disagree
Strongly Disagree

I take a positive attitude toward myself.

Strongly Agree
Agree
Disagree
Strongly Disagree

On the whole, I am satisfied with myself.

Strongly Agree
Agree
Disagree
Strongly Disagree

I wish I could have more respect for myself.

Strongly Agree
Agree
Disagree
Strongly Disagree

I certainly feel useless at times.

Strongly Agree
Agree
Disagree
Strongly Disagree

At times I think I am no good at all.

Strongly Agree
Agree
Disagree
Strongly Disagree

APPENDIX B. Signed Approval Forms

San José State
UNIVERSITY

Office of the Provost
Associate Vice President
Graduate Studies & Research

One Washington Square
San José, CA 95192-0025
Voice: 408-924-2427
Fax: 408-924-2427

E-mail: gradstudies@sjsu.edu
http://www.sjsu.edu

To: Sharon Furlington

From: Pamela Stacks, Ph.D.
Associate Vice President
Graduate Studies and Research

Date: March 24, 2008

The Human Subjects-Institutional Review Board has approved your request to use human subjects in the study entitled:

"Self-reported sleep habits in adolescent girls"

This approval is contingent upon the subjects participating in your research project being appropriately protected from risk. This includes the protection of the anonymity of the subjects' identity when they participate in your research project, and with regard to all data that may be collected from the subjects. The approval includes continued monitoring of your research by the Board to assure that the subjects are being adequately and properly protected from such risks. If at any time a subject becomes injured or complains of injury, you must notify Dr. Pamela Stacks, Ph.D. immediately. Injury includes but is not limited to bodily harm, psychological trauma, and release of potentially damaging personal information. This approval for the human subject's portion of your project is in effect for one year, and data collection beyond March 24, 2009 requires an extension request.

Please also be advised that all subjects need to be fully informed and aware that their participation in your research project is voluntary, and that he or she may withdraw from the project at any time. Further, a subject's participation, refusal to participate, or withdrawal will not affect any services that the subject is receiving or will receive at the institution in which the research is being conducted.

If you have any questions, please contact me at (408) 924-2480.

Protocol # S0802059

cc. Ron Rogers, 0120

The California State University:
Chancellor's Office
Bakersfield, Channel Islands, Chico,
Dominguez Hills, East Bay, Fresno,
Fullerton, Humboldt, Long Beach,
Los Angeles, Maritime Academy,
Merced, Monterey, Stanislaus,
Sacramento, San Bernardino, San Diego,
San Francisco, San Jose, San Luis Obispo,
San Marcos, Sonoma, Stanislaus

March 10, 2008

To Whom It May Concern:

This is to indicate that The Girls' Middle school is happy to permit Sharon Turlington to use data collected as part of the ongoing GMS/SRI Sleep Survey for her project in Psychology at San Jose State University.

Sincerely,

Laura Reeve
Science Teacher

Peter Koehler
Assistant Head of School

March 10, 2008

To Whom It May Concern:

This is to indicate that SRI International is happy to permit Sharon Turlington to collaborate and use data collected as part of the ongoing GMS/SRI Sleep Survey for her project in Psychology at San Jose State University. The study entitled, "Self Reported Sleep Habits in Adolescent Girls," was approved by the Human Subjects Committee at SRI International on February 28, 2008 and assigned Case #1044. Consent will be obtained by SRI International in accordance with Federal Guidelines.

Sincerely,

Ian M. Colrain Ph.D.
Director, Human Sleep Research Program
SRI International
650-859-3915

SRI International

333 Ravenswood Avenue • Menlo Park, California 94025-3493 • 650.859.2000