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Poor Sleep as a Risk Factor for Nonsuicidal Self-Injury in Adolescent Girls

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Abstract The purpose of this study was to examine the relation between poor sleep and nonsuicidal self-injury (NSSI), and to test the hypothesis that poor sleep is a risk factor for the development of NSSI in young adolescents. Questionnaire data were used from a 2-wave longitudinal study of a community sample of 881 young Swedish adolescents. The results showed that 7 % of the girls reported poor sleep (never or seldom sleeping well), and 20–26 % of the girls reported repeated NSSI (at least 5 instances). Poor sleep was associated prospectively with NSSI among girls, but not among boys. Of girls who responded that they seldom or never slept well at T1, 77 % reported repeated NSSI 1 year later. Poor sleep at T1 was found to predict the incidence of new cases of repeated NSSI in girls at T2, independently of their degree of psychopathology. No similar relationship between poor sleep and NSSI was found in boys. The present results suggest that screening for poor sleep in adolescents may serve to identify a subgroup of girls at risk for developing NSSI. It is concluded that poor sleep in young girls should be taken seriously, even in the absence of other self-reported psychological problems, and that interventions targeted at sleep disturbances may be important for prevention.

Keywords Nonsuicidal self-injury · Sleep · Adolescents · Prospective design · Risk factors

Although sleep disturbance has traditionally been seen as a symptom of psychopathology, rather than as an independent risk factor for the development of psychopathology, recent research has led to re-thinking. For example, evidence from longitudinal studies indicates that insomnia is an independent risk factor for the development of a number of psychiatric disorders among adults, including depression (Breslau et al. 1996; Chang et al. 1997; Mallon et al. 2000; Roberts et al. 2000), and also for suicide (Fawcett et al. 1990; Fujino et al. 2005) and suicidal ideation (McCall et al. 2010).

Adolescence is characterized by changes in sleep patterns and habits, and there is evidence that many adolescents frequently get insufficient sleep. For example, Johnson et al. (2006) reported a prevalence of insomnia at 11 % among 13–16-year-olds; and Roberts et al. (2008) found a point prevalence of one or more symptoms of insomnia for 27 % of 11–17-year-old adolescents, with 5 % meeting diagnostic criteria for insomnia. Sleep regulation is important for adolescent health development in a number of ways (e.g., Dahl and Lewin 2002). For example, there is evidence that sleep disturbance among adolescents is a risk factor for depression as well as a number of other somatic, psychological and interpersonal problems (Roberts et al. 2002), internalizing as well as externalizing problems (Meijer et al. 2010), and also for suicidal ideation and suicidal behavior (Goldstein et al. 2008; Wong et al. 2011).

Among adolescents, a less lethal form of self-destructive behavior, most often referred to as nonsuicidal self-injury (NSSI; e.g., Klonsky 2007; Muehlenkamp 2005; Nock 2010), has received increased attention from clinicians and researchers during the last decade. NSSI is defined by Nock and Favazza (2009) as the direct, deliberate destruction of one's own body tissue in the absence of suicidal intent; common examples are cutting, carving, biting, burning, severe scratching, punching or banging oneself, sticking sharp objects into the skin, and preventing wounds from healing. There is little research on the association between NSSI and deficient sleep, and no longitudinal studies have so far studied sleep disturbance as a potential risk factor for the development of NSSI in adolescents. Wong et al. (2011) found that sleep problems in 12–14 year old adolescents predicted suicide attempts and/or self-harm (as measured by

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the item "I deliberately try to harm or kill myself") when they were 15–17 years old, even when controlling for depressive symptoms. However, because this item does not differentiate between suicide attempts and non-suicidal self-injury, their results cannot be said to provide evidence that poor sleep is a risk factor for NSSI.

A risk factor is generally defined (e.g., Kraemer et al. 1997) as a measurable variable that precedes a negative outcome and is associated with a higher risk for this outcome; this means that risk factors can only be identified by means of prospective studies. In a previous study (Lundh et al. 2011), we found that general psychopathology, as measured by Goodman's Strength and Difficulties Questionnaire (SDQ), was a risk factor for NSSI 1 year later. The aim of the present study was to extend this research to sleep problems. Evidence indicates that NSSI often serves as a strategy for dealing with negative aspects of life, which is likely to develop in individuals who lack access to more adaptive strategies (e.g., Klonsky 2009; Nock and Prinstein 2004). If poor sleep not only causes increased stress and lowers life quality, but also undermines mood regulation and cognitive functioning more generally (e.g., Dahl and Lewin 2002; Harvey et al. 2006), it may also be hypothesized to increase the risk for the development of dysfunctional strategies like NSSI.

Because NSSI is not a psychiatric diagnosis, there are no DSM criteria to use for the purpose of defining "cases" of NSSI. In the present study we defined cases of repeated NSSI in terms of the self-report of at least five instances of self-reported self-injury. This is consistent with Muehlenkamp's (2005) suggestion of adopting "deliberate self-injury syndrome" as a new psychiatric diagnosis; one of the proposed criteria is a repetitive pattern of self-injury in which five or more acts of self-injury have occurred. It is also consistent with the proposal that Non-Suicidal Self-Injury Disorder should be included as a new diagnosis in the DSM-5 as (American Psychiatric Association 2012); according to one of the criteria, the individual has "on 5 or more days" engaged in intentional self-inflicted damage to the surface of his or her body.

On the basis of previous research on sleep and health in adolescents (e.g., Dahl and Lewin 2002; Roberts et al. 2002, 2008), we expected that poor sleep would be associated with increased NSSI not only cross-sectionally but also longitudinally. The main focus was on the incidence of NSSI, defined as the appearance of new cases of repeated NSSI in adolescents who did not report any NSSI previously. For this purpose we used data from a longitudinal study of a community sample of young Swedish adolescents, with data collection on two occasions with a 1 year interval. Because this research project was not originally designed to study the association between sleep and NSSI, sleep disturbance was only measured by one global question, asking about the quality of the participants' sleep in general. Sleep disturbances can take a variety of forms – including difficulties initiating sleep, difficulties maintaining sleep, early awakenings, hypersomnia, restless or nonrestorative sleep, etc. – and the use of a single item measure means that we were not able to differentiate between these varieties of sleep disturbances. In other words, we expected that a global experience of poor sleep would be a risk factor for the development of NSSI. Because there seem to be gender differences in the development of sleep disturbances during adolescence (e.g., maturational development being associated with insomnia in girls but not in boys; Johnson et al. 2006) and also in the developmental and psychopathological significance of NSSI during adolescence (e.g., NSSI showing more stability, and being more associated with psychopathology among girls than among boys; Bjärehed et al. in press), we carried out separate analyses for girls and boys.

To summarize, our hypotheses were as follows: (1) Poor sleep will show not only a cross-sectional but also a prospective association with NSSI among young adolescents. (2) The incidence of new cases of repeated NSSI at T2 will be predicted by poor sleep at T1, even when controlling for psychopathology.

Method

Participants

The participants were a community sample from a municipality in the south of Sweden with around 40.000 inhabitants, which was fairly representative for the rest of Sweden (for further details, see Lundh et al. 2008). At T1, there were 532 students in Grade 7 (13–14 years old) and 520 students in Grade 8 (14–15 years old) in regular school in this municipality; 992 of these 1,052 students (=94 %) participated. Of the 60 adolescents who did not participate, 9 chose to refrain from participation (either on their own or their parents' initiative), whereas the remaining 51 were absent from school during data collection. At T2, 984 students in Grade 8 and 9 participated. Ten individuals were excluded as multivariate outliers with stereotypic response patterns. In total, there were available longitudinal data on self-injury for 886 participants (452 girls and 434 boys). Of these, data on T1 sleep was missing for 5 participants, thereby reducing the sample for the analysis of risk factors to 881 participants (450 girls and 431 boys), representing 84 % of all students that were available for inclusion at T1.

Instruments

Deliberate Self-Harm Inventory, 9-item version (DSHI-9r) is a shortened and modified version of Gratz' (2001) Deliberate Self-Harm Inventory (DSHI), adapted to adolescents by Bjärehed and Lundh (2008), and slightly revised on the basis of their results. In the present revised 9-item version of

the inventory the respondents are asked if they have deliberately engaged in any of nine different forms of NSSI (cutting wrists, arms, or body areas; minor cutting[1] causing bleeding; carving words, pictures, etc. into the skin; burning oneself with cigarette, lighter or match; severe scratching, causing bleeding; sticking sharp objects into the skin; biting oneself so that the skin is broken; punching oneself or banging one's head, thereby causing a bruise; and preventing wounds from healing) during the past 6 months. Respondents are instructed to rate the number of times (from 0 to 5) they have engaged in each of these behaviors, or if they have engaged in them "more than five times" (scored as 6). A total NSSI score was computed by summarizing the scores on all DSHI-9r items (ranging from 0 to 54). The internal consistency of the DSHI-9r in the present study was α=.90.

Sleep problems was assessed by means of one single question, "Do you sleep well?", with a Likert response format and five response alternatives: Always, Most often, Sometimes, Seldom, and Never. A pilot study, carried out by the authors of this paper, with 80 adolescents who answered this question on two occasions, with a mean test interval of 7 weeks and 4 days, showed a test-retest correlation of r=.64. Because the periods between assessments were longer than is usual in studies of test-retest reliability (which should ideally not be more than about 1 month) the test–retest coefficient obtained was assumed to set a lower boundary for the true test-retest reliability of this measure of sleep problems.

The Strengths and Difficulties Questionnaire – self-report version (SDQ-s; Goodman 1997) is a widely used screening instrument for psychological problems among children and adolescents. It contains 25 statements, with three response alternatives that are scored from 0 to 2: "Not true", "Somewhat true", and "Certainly true". The participants are instructed to respond to each item on the basis of how things have been for them during the last 6 months. The items are divided into five scales with five items each: Hyperactivity-Inattention, Emotional Symptoms, Conduct Problems, Peer Problems and Prosocial Behaviour. The four first-mentioned scales are summed to generate a Total Difficulties score; the present study used this Total Difficulties score as a measure of general psychopathology. The SDQ was translated into Swedish by Smedje et al. (1999), and the self-report version was empirically validated by Lundh et al. (2008). Cronbach's alpha for SDQ Total Difficulties in the present study was .75 at T1, and .74 at T2.

[1] In the Swedish language, there is a differentiation between "skära" (which is deeper) and "rispa" (which is more superficial). In the present paper, this distinction has been translated into "cutting" and "minor cutting".

Procedure

The instruments used in the present study were part of an 11-page questionnaire, which was filled out in school, as part of a separate lecture hour, and was administered by research assistants from Lund University, who were either licensed psychologists or advanced level students of psychology. A teacher was present, but did not participate in the data collection. Each questionnaire had a code number to make it possible to match the students' answers on the two test occasions, while preserving their anonymity. After the completion of the questionnaire it was sealed in an envelope by the student.

This research was conducted after approval by the Regional Ethics Committee at Lund University. Contact was established with school-managements via head-masters who gave consent to their schools' participation in the study. Information about the form and purpose of the study was distributed to the adolescents in school and sent by mail to their parents, who were asked to contact the school teachers or the researchers if they did not want their child to participate. The students were informed that their participation was voluntary, that their answers were treated confidentially, and that no school personnel would have access to their answers.

Data Analysis

To calculate scores on the SDQ, we required that the individual should have at most one missing value on each subscale; in that case, that individual's mode value for this subscale was imputed. (Imputation is considered a better method for handling data than deleting cases with missing data, as the latter may distort the representativity of the sample studied; e.g., Jeličič et al. 2010). To calculate total scores on the DSHI-9r, we required that the individual should have no more than three missing values. In these cases, we interpreted these individuals' missing values conservatively as the absence of the self-injurious behavior asked for (i.e., imputing 0). As the DSHI-9r scores at both T1 and T2 were highly skewed and leptokurtic, logarithmic transformations were conducted, resulting in acceptable normal distributions.

The cross-sectional and longitudinal associations between sleep and NSSI were first analyzed by zero-order correlations and partial correlations. The hypothesis that poor sleep at T1 would predict the incidence of repeated NSSI at T2 was then tested by means of binary logistic regression.

Results

Descriptive Data on Sleep

Good sleep (defined as sleeping well "always" or "most often") was reported more frequently by boys than by girls.

Among the boys 85.2 % and 83.5 %, respectively, reported good sleep at T1 and T2. Among the girls the corresponding figures were 75.2 % and 78.8 %. The percentages who reported that they "never" or "seldom" slept well, however, were very similar among girls (6.9 % at T1 and 6.4 % at T2) and boys (6.4 % and 6.1 %), and comparisons with all five response alternatives by chi square showed no significant gender difference neither at T1, $\chi^2(4) = 8.52$, $p=.074$, nor at T2, $\chi^2(4) = 4.85$, $p>.30$.

Descriptive Data on NSSI

Prevalence Rates At T1, 41.6 % of the participants (45.2 % of the girls and 38.1 % of the boys) reported that they had injured themselves deliberately at least once; the corresponding figure at T2 was 41.8 % (48.2 % of the girls and 35.1 % of the boys). Repeated NSSI (defined as at least 5 instances of self-injury) was reported by 18.3 % at T1 (20.7 % of the girls and 15.9 % of the boys), and by 20.3 % at T2 (25.6 % of the girls and 14.8 % of the boys). Table 1 shows a cross-tabulation of the number of participants who reported no NSSI, occasional NSSI (1–4 instances) and repeated NSSI (5 or more instances) at T1 and T2. On the basis of these data, incidence rates at T2 were computed.

Incidence Rates Incidence here refers to subjects who were a case of repeated NSSI at T2 (defined as reporting at least five instances of NSSI at T2) but had reported *no* single instance of NSSI at T1. In total, 527 individuals (252 girls and 275 boys) reported no NSSI at T1. The incidence rate of repeated NSSI in this group at T2 was 10.3 % (26 of 252) among the girls, and 7.6 % (21 of 275) among the boys.

Correlations Between NSSI, Poor Sleep, and Psychopathology

Table 2 shows the correlations between NSSI, poor sleep and psychopathology (as measured by the SDQ Total Difficulties). Although NSSI correlated consistently with psychopathology in both girls and boys, the pattern of correlations between NSSI and poor sleep was clearly more apparent among girls than boys. In particular, it may be noted that poor sleep at T1 correlated $r=.40$ with T2 NSSI in girls, whereas it correlated only $r=.13$ among the boys; this difference was significant ($z=4.33$, $p<.001$). Partial correlations between T1 Poor sleep and T2 NSSI, controlling for T1 NSSI and T1 SDQ Total Difficulties, were $r=.19$, $p<.0001$ in girls, and $r=.03$, ns, in boys. The hypothesis that poor sleep would correlate with NSSI not only cross-sectionally but also longitudinally was, therefore, confirmed in girls but not in boys.

Figure 1 shows the association in girls between sleep at T1 and repeated NSSI at T2. Repeated NSSI at T2 was reported by 20 of the 26 girls (76.9 %) who had reported generally poor sleep (defined as "never" or "seldom" sleeping well) at T1. In comparison, repeated NSSI at T2 was reported by 19.7 % of the girls (71 of 361) with good sleep (defined as sleeping well "always" or "most often") at T1, and by 37.5 % of the girls (24 of 64) with a mixed quality of sleep (defined as sleeping well "sometimes") at T1.

Predicting New Cases of NSSI

To test the hypothesis that poor sleep would predict the incidence of new cases of NSSI, independently of psychopathology, logistic regressions were carried out in the subsamples of girls and boys who reported no NSSI on T1, with poor sleep and SDQ Total Difficulties as independent variables, and the dichotomized outcome defined by the cut-off of DSHI9r≥5 at T2 as the dependent variable. The model was significant in girls, $\chi^2(2) = 11.49$, $p=.003$, explaining 9.4 % of the variance (*Nagelkerke* $R^2=0.094$), but not in boys, $\chi^2(2) = 4.98$, $p=.083$ (*Nagelkerke* $R^2=0.042$). As seen in Table 3, the incidence of repeated NSSI was predicted significantly by poor sleep among the girls, independently of psychopathology.

Discussion

The present results suggest that poor sleep is a risk factor for the development of NSSI among young girls, even when degree of general psychopathology is controlled for. This may have important implications for the prevention of NSSI. Poor sleep in adolescent girls should be taken seriously, even in the absence of other psychological problems, and interventions targeted at sleep disturbances may be important for prevention of NSSI.

When the cut-off for poor sleep in the present study was set to include all participants who reported that they "never" or "seldom" sleep well, poor sleep was reported by 6–7 % in both girls and boys. These rates are quite consistent with

Table 1 Cross-tabulation of the number of adolescents (Girls, Boys) who reported no NSSI, occasional NSSI (1–4 instances), and repeated NSSI (at Least 5 Instances) at T1 and T2

	T2 No NSSI	T2 Occasional NSSI	T2 Repeated NSSI	Total
T1 No NSSI	402 (185, 217)	78 (41, 37)	47 (26, 21)	527 (252, 275)
T1 Occasional NSSI	84 (39, 45)	77 (43, 34)	48 (30, 18)	209 (112, 97)
T1 Repeated NSSI	34 (11, 23)	32 (18, 14)	84 (59, 25)	150 (88, 62)
Total	520 (235, 285)	187 (102, 85)	179 (115, 64)	886 (452, 434)

Table 2 Correlations between poor sleep, psychological difficulties (SDQ total difficulties) and NSSI (Correlations for girls above the diagonal, and for boys below)

	T1 Sleep	T2 Sleep	T1 SDQ	T2 SDQ	T1 NSSI	T2 NSSI
T1 Sleep	–	.54**	.50**	.39**	.42**	.40**
T2 Sleep	.51**	–	.33**	.40**	.32**	.39**
T1 SDQ	.28**	.20**	–	.68**	.53**	.38**
T2 SDQ	.22**	.34**	.54**	–	.41**	.45**
T1 NSSI	.22**	.10	.40**	.30**	–	.60**
T2 NSSI	.13*	.23**	.32**	.42**	.41**	–

*$p<.01$; ** $p<.001$

epidemiological studies (Johnson et al. 2006; Roberts et al. 2008) which indicate that 5–11 % of adolescents suffer from insomnia. Although we cannot know from the present data to what extent the adolescents who reported poor sleep did suffer from insomnia or from other sleep disturbances, it is interesting to note that it was particularly among girls with poor sleep that NSSI was overrepresented. Of girls who responded that they seldom or never slept well, 77 % reported repeated NSSI 1 year later – as compared with 20 % of the girls who slept well at T1.

An interesting result is that, although girls and boys did not differ significantly in self-reported sleep, and actually showed relatively small differences in rates of NSSI, the *relation* between sleep and NSSI was very different in girls and boys. The correlations between sleep and NSSI in boys were small, and there was no indication that poor sleep was a risk factor for the development of NSSI in boys. In girls, on the other hand, the correlations were considerably larger, and poor sleep was found to predict new cases of repeated NSSI independently of overall psychopathology.

These results raise two questions: (1) Why should poor sleep be a risk factor for NSSI? (2) And why should it be a risk factor for NSSI only among girls, and not among boys? As to the first question, poor sleep may lead both to an increased emotional distress and to an impairment of cognitive functions (concentration, memory, judgment, problem solving, etc.) that are required for an adaptive coping with emotional distress. It is generally agreed that the most common function of NSSI is the regulation of emotional distress (e.g., Klonsky 2007, 2009). If it is assumed that NSSI is a less cognitively demanding form of emotion regulation (i.e., requires less of concentration, memory, judgment and problem solving than many other forms of emotion regulation), and that poor sleep generally increases the likelihood that the individual turns to less cognitively demanding forms of emotion regulation, it follows that poor sleep may increase the risk for NSSI.

But why, then, does this not occur in boys? There are a number of possibilities here. Maybe poor sleep is different in boys than in girls; one possibility is that poor sleep in girls more often takes the form of insomnia, and that insomnia has different effects than other kinds of sleep problems – because we only asked a general question about sleep, however, we cannot differentiate between different forms of sleep problems in the present study. Another possibility is that poor sleep does not have similar effects in boys as in girls – for example, if girls tend to respond to poor sleep with more emotional distress than boys, then boys will have less emotional distress to regulate. A third possibility is that, girls and boys self-injure in different ways, and with different functions. For example, although research indicates that girls and boys engage in NSSI at relatively equivalent rates, girls engage in more self-cutting than boys (e.g., Baetens et al. 2011), and maybe cutting tends to have more of an emotion regulation function than other forms of NSSI. A fourth possibility is that boys with poor sleep turn to other forms of emotion regulation than girls – for example, behaving aggressively towards others rather than towards themselves. These possibilities should be explored in further research.

In general, it may be hypothesized that NSSI has another developmental and psychopathological meaning in girls than in boys; this is also consistent with the fact that girls present much more frequently than boys with clinically relevant forms of self-injury in psychiatric settings. Also, NSSI seems to be more stable in girls than in boys, and to be more associated with psychopathology (Bjärehed et al. in press). The prospective association between poor sleep and NSSI that was found in the present study may be one further example of the latter. At the same time, it should be noted

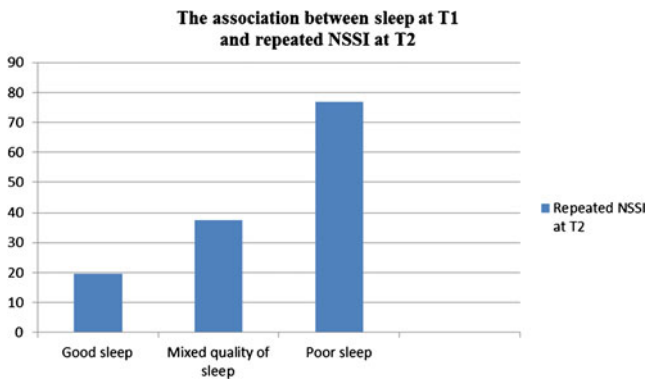

Fig. 1 Percentages of girls with repeated NSSI at T2 as a function of their self-reported quality of sleep at T1

Table 3 Logistic regressions, predicting incidence of repeated NSSI at T2 from poor sleep and psychological difficulties (SDQ Total Difficulties) at T1

Variables	*b*	SE (*b*)	Wald(1)	OR	95 % Confidence intervals	
					Lower	Upper
Girls						
Poor sleep	.64	.29	5.03*	1.90	1.08	3.32
SDQ Total Diff.	.08	.05	2.86	1.09	0.99	1.20
Constant	−4.23	.69	38.16***	.02		
Boys						
Poor sleep	−.10	.33	.10	.90	0.47	1.72
SDQ Total Diff.	.12	.05	5.11*	1.12	1.02	1.24
Constant	−3.38	.78	20.01***	.03		

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

that the majority of girls who reported repeated NSSI at T2 actually reported good sleep (i.e., always or most often sleeping well); this means that, even if poor sleep is a risk factor for the development of NSSI, this characterizes merely one of several possible pathways to the development of NSSI among girls.

The reported rates of NSSI in the present study are high. At T1, for example, 41.6 % of the participants reported at least one instance of NSSI. This percentage, however, is similar to those found internationally when similar checklist questionnaires are used, that is, anonymous self-report questionnaires that present the participants with a list of nine or more specific forms of self-injury. For example, Lloyd-Richardson et al. (2007) reported a rate of 46.5 % in an American community sample of adolescents when using another such checklist questionnaire, the Functional Assessment of Self-Mutilation (FASM). On the other hand, studies which rely on one-item general questions asking the participants whether they have ever hurt themselves on purpose, or engaged in non-suicidal self-injury, generally report considerably lower rates; Ross and Heath (2002), for example, found that 21.2 % of the adolescents in their community sample reported that they had harmed themselves on the basis of such a one-item measure. These divergent rates may be due to how the questions are asked, which is seen most clearly when both of these methods are used in the same study with the same sample. For example, in a randomly selected community sample of 3,060 Swedish adolescents aged 15–17 years, Zetterqvist et al. (2012) found a prevalence of 36 % with the FASM checklist questionnaire versus 17 % when using the general question "Have you ever actually engaged in non-suicidal self-injury (that is, purposely hurt yourself without wanting to die, for example by cutting or burning)?", which was derived from Nock et al. (2007) Self-Injurious Thoughts and Behaviors Interview (SITBI). One possible explanation of these divergent rates is that these two ways of asking questions serve as retrieval cues for different kinds of information in the respondents' memory: Whereas checklist questionnaires serve as retrieval cues for information in the participants' *episodic* memory (i.e., memories of specific events and episodes), general questions about self-injury probably serve as retrieval cues primarily for information in the participants' *semantic* memory (i.e., more general beliefs about themselves, for example, as being a person who "injures oneself").[2] This would mean that if we are interested in specific self-injurious behaviors we should preferably use checklist questionnaires, whereas general questions about engaging in self-injury might be preferred if we are interested in searching for participants who identify themselves as "self-injurers".

Another aspect of the problem of assessment is that self-assessment questionnaires generally tend to produce higher rates of NSSI than interview measures. For example, Ross and Heath (2002) found that while 21.2 % of respondents responded affirmatively to the item about self-injury in their questionnaires, only 13.9 % were categorized as engaging in self-injury on the basis of a semi-structured follow-up interview collecting additional information about these behaviors. This kind of divergence is likely to have at least two possible sources; over-reporting on the questionnaire, and an unwillingness to disclose NSSI in an interview.

The present study suffers from several limitations. First, it relies entirely on self-assessment in measuring both sleep and NSSI. Sleep was measured by only one item asking about global sleep quality, and the results do not point out any special aspect of poor sleep (e.g., non-restorative sleep, difficulty in initiating sleep, early awakenings, delayed sleep phase, nightmares, etc.) as particularly related to risk for NSSI. Also, there was no independent verification of sleep quality from parents or others, and no objective recordings

[2] Or, alternatively, if the general question about NSSI contains exemplifications (e.g., mentioning cutting and burning as examples of NSSI), it may be expected to activate a mix of episodic and semantic information – although the information from episodic memory will probably be restricted to episodes characterized by the specific examples of NSSI mentioned in the question, thereby leading to lower rates of self-reported NSSI than typical checklist questionnaires which contain a wider range of examples.

of sleep; it would be of interest to see if polysomnography or actigraphy (i.e., measures of sleep which do not rely on self-report) would show a similar association with NSSI. Similarly, the incidents of NSSI were not corroborated by external sources; although it may be argued that the individual him/herself is the best source of information about NSSI, in particular if confidentiality can be granted, it is still impossible to know for certain whether the endorsed incidents actually happened, or whether they represent genuine NSSI. Second, the study used only two time points, and it is possible that other results on risk factors would have been obtained with more measurement points, or other measurement points. For example, it would be of interest to measure sleep earlier during development, before the first onset of NSSI, to study risk factors in a larger group of new NSSI cases; in the present sample 18.3 % of the adolescents reported repeated NSSI already at T1, and there were only 47 new cases (26 girls and 21 boys, altogether an incidence of 8.9 %) of NSSI at T2. Third, psychopathology was measured merely by a short screening instrument, the Strengths and Difficulties Questionnaire (SDQ); it would be possible to draw stronger conclusions if the present findings were replicated with more comprehensive measures of psychopathology.

On the other hand, the study also has several strengths: it uses a large representative sample of adolescents, and includes longitudinal data on both NSSI and sleep for 84 % of all adolescents. Finally, to summarize, the present study contributes to the literature by showing evidence of poor sleep as a risk factor for NSSI in young girls, and suggests that screening for poor sleep in adolescents may serve to identify a subgroup of girls at risk for developing NSSI.

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