

# Self-Compassion as a Mediator Linking Sleep Disturbances with Non-Suicidal Self-Injury: A Four-Wave, Cross-Lagged Study

Xuliang Shi<sup>1,\*</sup>, Miaomiao Hou<sup>1,\*</sup>, Xiaoyan Chen<sup>2</sup>, Ya Zhu<sup>3</sup>

<sup>1</sup>College of Education, Hebei University, Baoding, Hebei Province, 071002, People's Republic of China; <sup>2</sup>Department of Applied Social Sciences, The Hong Kong Polytechnic University, Hong Kong; <sup>3</sup>Center for Mental Health Education and Counseling, Guangdong University of Science and Technology, Dongguan, Guangdong Province, 523083, People's Republic of China

\*These authors contributed equally to this work

Correspondence: Xuliang Shi, Associate professor at the College of Education, Hebei University, Baoding, 071002, People's Republic of China, Email shixl163@163.com

**Objective:** This longitudinal study examined the reciprocal relationship between sleep disturbances with non-suicidal self-injury and whether self-compassion mediates these associations.

**Methods:** A total of 5785 freshmen were sampled from a large-scale health-related cohort among Chinese college students at the baseline. This study spanned six waves with a six-month interval between each wave. Data from the last four waves were used because self-compassion or non-suicidal self-injury was not measured in the first two waves. The cross-lagged panel models were used to examine the longitudinal dynamic relationships between sleep disturbances, self-compassion, and non-suicidal self-injury.

**Results:** The results showed that all the auto-regressive paths were significant. For the cross-lagged paths, there was a reciprocal relation between sleep disturbances and self-compassion. Importantly, self-compassion played a longitudinal mediating role in the prediction from sleep disturbances to non-suicidal self-injury (indirect effect = 0.007 to 0.009, all  $p$  values < 0.001).

**Conclusion:** Psychological interventions targeting improved sleep quality and self-compassion may hold great promise for reducing the incidence of non-suicidal self-injury.

**Keywords:** sleep disturbances, self-compassion, NSSI, longitudinal design

## Introduction

Non-suicidal self-injury (NSSI) is a growing clinical and public health problem.<sup>1-3</sup> NSSI was defined as the deliberate damage to body tissue without suicidal intent, and it is not socially or culturally sanctioned.<sup>4</sup> Examples of NSSI behaviors include cutting or carving the skin, self-battery, and severe scratching.<sup>4-6</sup> College students, who are in the transition from adolescence to emerging adulthood, are particularly vulnerable to engaging in self-injury.<sup>7,8</sup> Previous studies have shown that approximately one in five students reported lifetime NSSI at college entrance,<sup>9</sup> and 15% of students initiate NSSI during the first two years of university.<sup>8</sup> NSSI has been associated with various adverse outcomes, including impaired academic functioning,<sup>10</sup> emotional disorders,<sup>11</sup> and increased suicidal ideation and attempts.<sup>12</sup>

Sleep problems, such as insomnia, irregular sleep patterns, and insufficient sleep duration, are prevalent among college students.<sup>13</sup> Previous research has shown that about 18.5% of college students reported insomnia, a rate higher than the rate of 7.4% reported in the general population.<sup>14</sup> Sleep problems, as a potential modifiable risk factor, have been evidenced to be associated with self-harming thoughts and behaviors in numerous cross-sectional and longitudinal studies.<sup>15-18</sup> A systematic review and meta-analysis have found that sleep problems including short sleep duration, sleep disturbances, and poor sleep quality were associated with non-suicidal self-injury.<sup>19</sup> In addition, some clinical intervention studies have suggested that cognitive-behavioral therapy for insomnia (CBT-I) can be beneficial in reducing

self-harming thoughts and behaviors.<sup>20</sup> Despite accumulating evidence establishing the relationship between sleep problems and NSSI, there are several limitations in the literature. First of all, most extant research has examined the directional path from sleep problems to NSSI, with limited evidence regarding whether NSSI affects sleep problems. NSSI does not effectively address the issues that cause emotional distress, leading individuals to feel powerless and experience an increased sense of hopelessness, which may increase their risk of sleep disturbances. Secondly, most previous studies have relied on cross-sectional or two-wave longitudinal designs, which provide limited insight into the long-term dynamic relationship between sleep problems and NSSI. Finally, although the relationship between sleep problems and NSSI has been established, the potential mechanisms underlying this relationship were understudied. Revealing these mechanisms would have important clinical significance in understanding the occurrence of NSSI.

Self-compassion refers to the practice of treating oneself with kindness and non-judgmental understanding when experiencing suffering or pain, which is an effective approach to deal with distressing thoughts and emotions.<sup>21</sup> Some studies have explored the relationship between sleep problems and self-compassion. On the one hand, accumulated experience of stressful life events over time is likely to have a deteriorating effect on one's ability to maintain self-compassion.<sup>22–24</sup> Chronic sleep disturbances, an important stressor, have been shown to be negatively associated with self-compassion. For instance, a cross-sectional study have found that fears of self-compassion and self-criticism mediated the relationship between poor sleep quality and mental health wellbeing.<sup>25</sup> On the other hand, individuals with high levels of self-compassion may have better sleep quality compared to those with low self-compassion. Self-compassionate individuals are less likely to repress or avoid painful feelings when facing inadequacies or challenges as they acknowledge that others may also experience similar situations.<sup>26</sup> Thus, self-compassion contributes to a more accepting and gentle attitude towards oneself,<sup>27,28</sup> which may foster better sleep hygiene practices and promote healthier sleep patterns.

In recent decades, self-compassion has gained significant attention in the field of self-injury. The benefits and barriers model of NSSI<sup>29</sup> proposes five barriers that prevent most people from engaging in self-injury: lack of awareness of NSSI, a positive view of the self, aversion to physical pain, aversion to NSSI stimuli, and social norms. For emerging adults, a positive view of self is considered the most significant barrier for preventing NSSI.<sup>29</sup> Self-compassion can be seen as a healthy way to value oneself. Self-compassionate individuals can process and accept emotional pain by paying full attention to thoughts and feelings, and treating them with understanding.<sup>26</sup> Increasing evidence has shown that self-compassion is a significant protective factor against NSSI.<sup>30–33</sup> Furthermore, self-compassion was positively related with adaptive coping and negatively related with maladaptive coping.<sup>34</sup> Extending from this notion, individuals with low self-compassion are more likely to rely on avoidance and maladaptive coping,<sup>35</sup> which ultimately leads to more NSSI behaviors.<sup>36</sup> However, previous studies have mainly relied on cross-sectional to examine the relationships between self-compassion and NSSI.<sup>32</sup> More longitudinal studies are needed to explore the dynamic relationship between these variables.

External stressors typically contribute to negative outcomes indirectly through individual psychological factors. Therefore, self-compassion may be an important potential mechanism linking external stressors and mental health problems.<sup>37–39</sup> For example, researchers have found that negative life events can diminish positive self-compassion processes (eg, self-kindness, common humanity, and mindfulness), which in turn puts students at greater suicidal risk.<sup>39</sup> Chronic sleep disturbances, an important negative life event, have been shown to be negatively associated with self-compassion. Currently, only one study has assessed the mediating effects of self-compassion between sleep problems and NSSI. Kim and coworkers in their cross-sectional study found that fears of self-compassion partially mediated the relationship between poor sleep quality and mental health wellbeing.<sup>25</sup> Thus, the pathways from sleep problems to NSSI through self-compassion are plausible. However, given that these potential mediating pathways have not been extensively examined, a more rigorous investigation of these proposed relationships is warranted. The cross-lagged panel model (CLPM) has been proven to be an effective technique for examining reciprocal causal effects using longitudinal data. Such an analysis could ultimately aid in the creation and execution of effective, targeted interventions to reduce the incidence of NSSI in young adults.

Previous findings have shown a close relationship between sleep problems, self-compassion, and NSSI.<sup>15–19,25,30–33</sup> However, longitudinal studies examining the dynamic relationships between these variables are limited. To address this gap, the present study employed a multi-wave longitudinal design to examine the dynamic longitudinal relationships between sleep disturbances, self-compassion, and NSSI. Based on the literature, three hypotheses were examined:

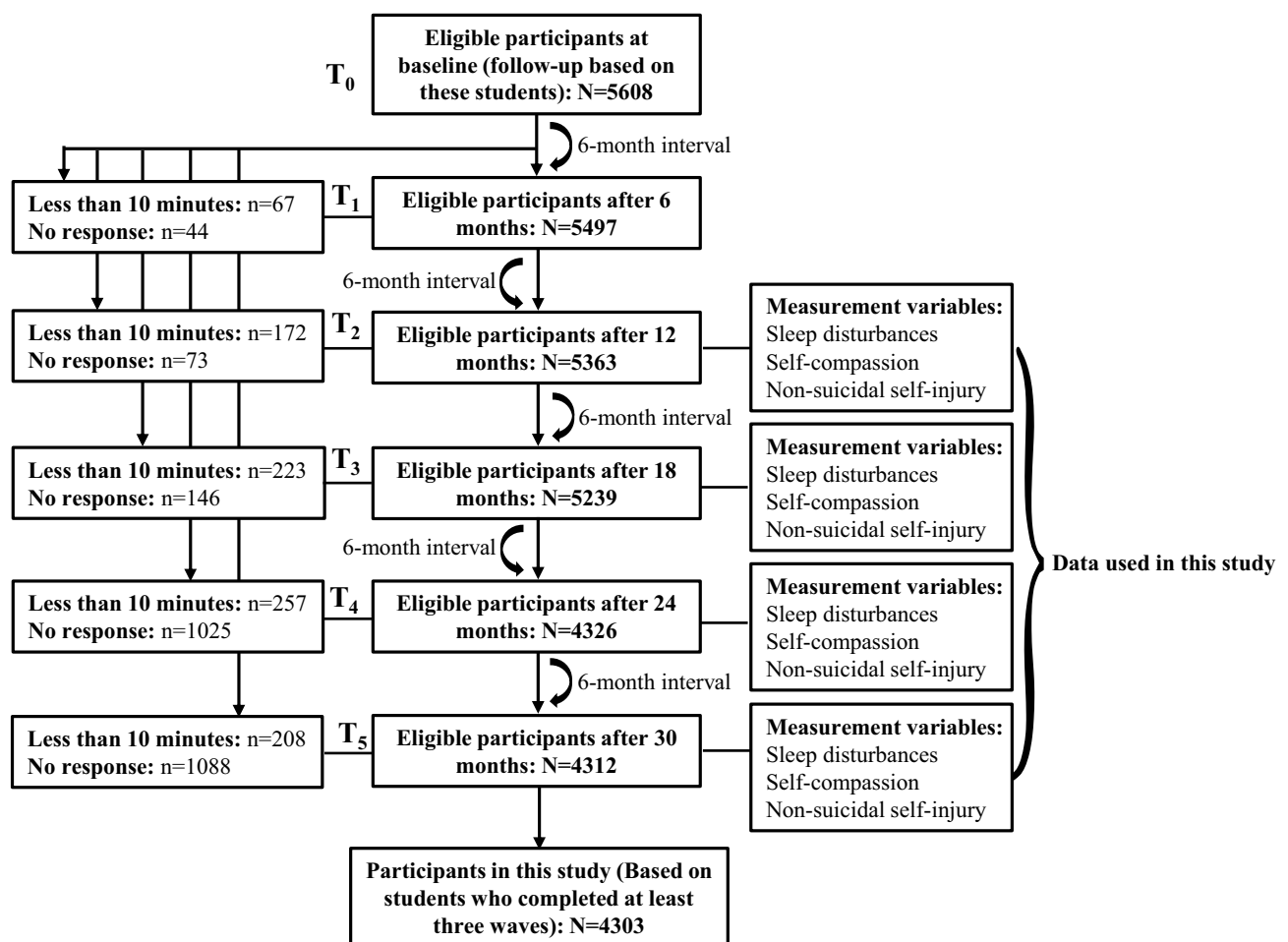
1) Sleep disturbances and NSSI would bidirectionally and positively predict each other; 2) Sleep disturbances and self-compassion would bidirectionally and negatively predict each other; 3) Self-compassion would mediate the longitudinal link from sleep disturbances to NSSI.

## Materials and Methods

### Participants and Procedures

Participants were selected from a large-scale health-related cohort among Chinese college students. This cohort was a six-wave prospective study from 2019 to 2022 in south China. Detailed sampling and data collection have been described in Figure 1. Briefly, at baseline ( $T_0$ , May 2020), 5608 freshmen (51.8% male,  $M_{age}=18.63$ ,  $SD=0.88$ ) from two public universities were identified for subsequent follow-up investigations. Of the participants at baseline, 5497 (2.0% attrition rate), 5363 (4.4% attrition rate), 5239 (6.6% attrition rate), 4326 (22.8% attrition rate), and 4312 (23.1% attrition rate) provided valid responses at Time 1 ( $T_1$ , October 2020), Time 2 ( $T_2$ , May 2021), Time 3 ( $T_3$ , October 2021), Time 4 ( $T_4$ , May 2022), and Time 5 ( $T_5$ , October 2022) respectively. The main reason for attrition was that students were absent from class on the day of the assessment. In the current study, we used data from  $T_2$  to  $T_5$  because self-compassion or non-suicidal self-injury was not measured at the baseline and Time 1. Ultimately, 4303 students (48.4% male,  $M_{age}=18.50$ ,  $SD=0.80$ ) who completed at least three waves were included in this study.

The missing completely at random (MCAR) test was used on all variables across the four waves of the study. The result showed that the data were not missing at a random ( $\chi^2=585.81$ ,  $df=197$ ,  $p<0.001$ ). According to Goodman and



**Figure 1** Sampling procedure for the current study.

**Notes:** "less than 10 minutes means" means that if the time it took to complete the survey was less than 10 minutes, the questionnaire was considered to be invalid.

Blum,<sup>40</sup> chi-square tests and *t* tests were conducted to compare demographic characteristics and outcome variables at baseline for participants who completed four surveys with those who did not. The results found that males ( $\chi^2 = 63.97$ ,  $df = 1$ ,  $p < 0.001$ ) were more likely to drop out. As for the outcome variables, students with higher self-compassion at T<sub>2</sub> were more likely to drop out ( $t=3.15$ ,  $p < 0.01$ ). No significant differences were found in other outcome variables. Therefore, the full information maximum likelihood (FIML) method was used in subsequent model estimations.<sup>41</sup>

Every academic year, Chinese universities organize mental health surveys for college students, and students were approached through these surveys. This organized questionnaire survey effectively reduces the rate of dropout. All participants completed an online mental health survey using mobile phones in a regular classroom environment with the help of trained teachers and graduate assistants. It took approximately 30 mins to complete the questionnaire. Before collecting data, we obtained permission from the principals of two schools and obtained informed consent from students. All participants were informed that their participation in the study was voluntary and that they could withdraw from the study at any time without repercussions. The present study protocol was reviewed and approved by the Research Ethics Committee of Hebei University.

## Questionnaire Measures

### Sleep Disturbances

Sleep disturbances were measured using the Youth Self-Rating Insomnia Scale (YSIS).<sup>42</sup> The YSIS consists of 8 items assessing insomnia symptoms, perceived sleep quality, sleep insufficiency, sleep dissatisfaction, and interference of sleep difficulties with daytime functioning. Insomnia symptoms were measured with three items: “Trouble falling asleep”, “Wake up frequently during the night”, and “Wake up very early and cannot get back to sleep”. Perceived sleep quality, sleep dissatisfaction, and sleep insufficiency were each assessed with one item: “During the past month, how would you rate the quality of your sleep overall?” “During the past month, how satisfied were you with your sleep overall?” “Do you feel that you do not have enough sleep”. Impaired daytime functioning was measured using two items: “Feel unrested and unrestored upon waking” and “Sleep disturbances interfere with your daily activities”. Perceived sleep quality is rated from 1=very good to 5=very poor and sleep dissatisfaction is rated from 1= very satisfied to 5=very unsatisfied. The remaining 6 items are rated on a five-point scale from 1 = never, 2 = rarely (<1 time/week), 3 = sometimes (1–2 times/week), 4 = often (3–5 times/week), to 5 = almost every day (6–7 times/week). The total score of YSIS ranges from 8 to 40, with a higher score reflecting more severe sleep disturbances during the past month. The YSIS has been found to have appropriate internal consistency and test-retest reliability,<sup>42</sup> and has been adopted in some studies.<sup>43,44</sup> In this study, Cronbach’s alpha values were 0.86, 0.75, 0.76, and 0.87 for T<sub>2</sub> to T<sub>5</sub>, respectively.

### Self-Compassion

Self-compassion was measured using the Self-Compassion Scale-Short Form (SCS-SF).<sup>45</sup> The SCS-SF is a short-form version of the original Self-Compassion Scale (SCS),<sup>21</sup> which has demonstrated adequate internal consistency (Cronbach’s alpha  $\geq 0.86$ ) and a near-perfect correlation ( $r=0.97$ ) with the original scale. The SCS-SF includes 12-item items, and all items are answered on a 5-point Likert scale ranging from 1 (almost never) to 5 (almost always). This scale comprises six dimensions measuring self-kindness, self-judgment, common humanity, isolation, mindfulness, and over-identification. After recoding the reversed items, all items are summed to get a total score ranging from 12 to 60. A higher total score indicates a higher level of self-compassion. The SCS-SF has demonstrated good psychometric properties in the Chinese college students.<sup>46</sup> In this study, Cronbach’s alpha values were 0.68, 0.71, 0.72, and 0.70 for T<sub>2</sub> to T<sub>5</sub>, respectively.

### Non-Suicidal Self-Injury

Non-suicidal self-injury was measured using seven items from the Deliberate Self-harm Inventory.<sup>47</sup> Participants were asked, “During the past six months, have you ever engaged in the following behaviors to hurt yourself deliberately without intention to kill yourself?”. These behaviors included cutting, burning, hitting, etc. Participants rated their engagement in these behaviors on a 7-point scale from 1=never to 7=six times or more. The score is calculated by

summing all responses, with higher scores indicating higher levels of NSSI. According to previous study,<sup>8</sup> NSSI was categorized into two groups: sporadic (ie, 1–4 times) and repetitive NSSI (ie,  $\geq 5$  times), based on the frequency of NSSI. Deliberate Self-harm Inventory has been widely used in previous studies.<sup>48,49</sup> In this study, Cronbach's alpha values were 0.96, 0.92, 0.90, and 0.86 for T<sub>2</sub> to T<sub>5</sub>, respectively.

## Covariates

Several demographic covariates were reported by the students at baseline, including students' gender (0 = female, 1 = male), age, and family economic status (0 = good, 1 = fair, 2 = poor).

## Data Analysis

Data analyses were divided into the following steps. First, descriptive statistics and zero-order correlation analysis were performed on the main variables. Second, confirmatory factor analysis (CFA) was adopted to evaluate the longitudinal measurement invariance for all measures across four measurement occasions. Measurement invariance was established when the model fit of different constraint models did not deteriorate significantly according to the changes in Comparative Fit Index ( $\Delta CFI \leq 0.010$ ) and Root Mean Square Error of Approximation ( $\Delta RMSEA \leq 0.015$ ) and Standardized Root Mean Squared Residual ( $\Delta SRMR \leq 0.010$ ).<sup>50</sup> Third, two cross-lagged panel models were conducted to examine the hypothesized relationships among sleep disturbance, self-compassion, and NSSI. The first model tested the association between sleep disturbance and NSSI by including the stability paths, within-wave associations, and cross-lagged effects. In the second model, we added self-compassion to the first model as a possible mediator to test the hypothesized full model. Participants' gender, age and family SES were entered in all models as time-invariant covariates across four time points. Due to the nonnormally distribution of NSSI, we used the maximum likelihood robust estimator (MLR) to obtain a more accurate parameter estimation. Multiple indicators were used to evaluate model fit: the comparative fit index (CFI; acceptable  $> 0.90$ ), the root mean square error of approximation (RMSEA; acceptable  $< 0.08$ ), and the standardized root mean square residual (SRMR; acceptable  $< 0.08$ ). The significance of the mediated effects was tested using the bias-corrected percentile bootstrap method with 1000 samples. The effect is significant if the confidence intervals did not include zero. Fourth, a multi-group approach was applied to test invariance across gender for the two cross-lagged panel models. All analyses in this study were performed using IBM SPSS version 26.0 and Mplus 8.4.

## Results

### Descriptive Analyses

Table 1 displays descriptive statistics and bivariate correlations about sleep disturbances, self-compassion, and NSSI. Sleep disturbances were significantly negatively correlated with self-compassion and positively correlated with NSSI at each time point. Self-compassion was significantly negatively correlated with NSSI at each time point. The ranges for skewness of sleep disturbances, self-compassion, and NSSI at the four time points were 0.68 to 0.82, 0.35 to 0.76, and 5.69 to 9.81, respectively, and the ranges for kurtosis of these variables were 0.29 to 1.21, 0.14 to 0.36, 36.05 to 125.23, respectively. As shown in Figure 2, 9.2%, 8.3%, 7.2%, and 10.2% of college students reported at least one self-injury behavior. More specifically, 6.7%, 5.8%, 5.1%, and 5.3% reported sporadic NSSI, and 2.5%, 2.6%, 2.1%, and 4.9% reported repetitive NSSI.

### Longitudinal Measurement Invariance

Longitudinal measurement invariance was tested to determine the degree of consistent measurement across time. As shown in Table 2, scalar invariance was established for self-compassion and NSSI measures, and metric invariance was established for sleep disturbances. These results indicated that observed changes in these variables over time were meaningful rather than reflecting measurement artifacts.

**Table 1** Zero-Order Correlations Among Main Variables

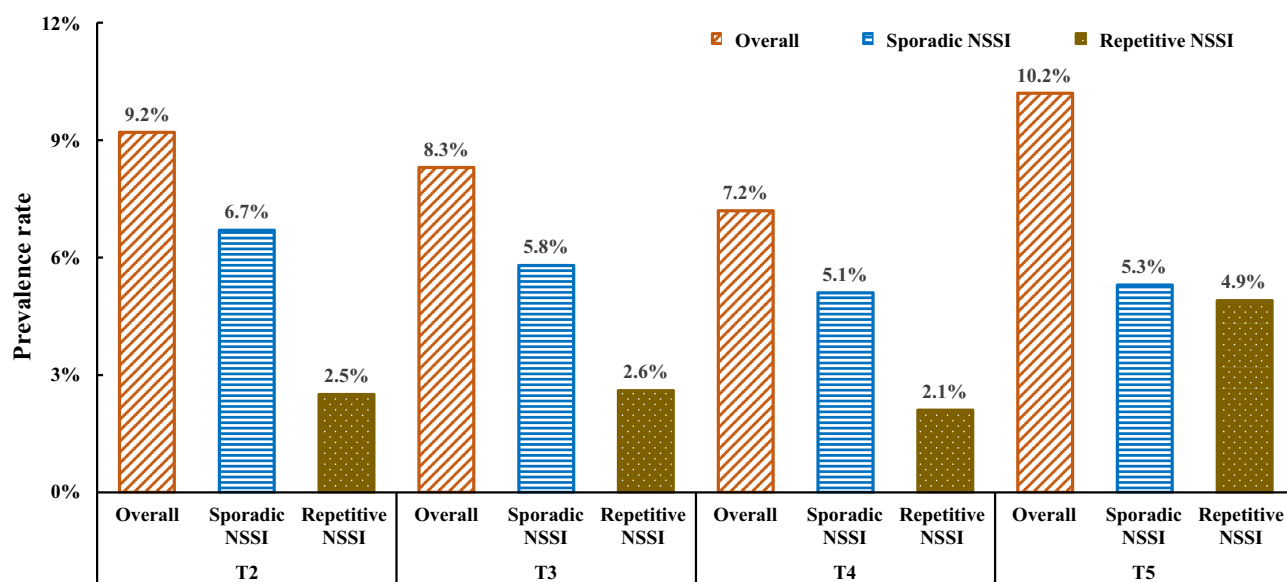
| Variables                               | 1     | 2     | 3     | 4     | 5     | 6     | 7     | 8     | 9    | 10   | 11   | 12   |
|---|-------|-------|-------|-------|-------|-------|-------|-------|------|------|------|------|
| 1. Sleep disturbances (T <sub>2</sub> ) | 1     |       |       |       |       |       |       |       |      |      |      |      |
| 2. Sleep disturbances (T <sub>3</sub> ) | 0.54  | 1     |       |       |       |       |       |       |      |      |      |      |
| 3. Sleep disturbances (T <sub>4</sub> ) | 0.55  | 0.61  | 1     |       |       |       |       |       |      |      |      |      |
| 4. Sleep disturbances (T <sub>5</sub> ) | 0.55  | 0.51  | 0.55  | 1     |       |       |       |       |      |      |      |      |
| 5. Self-compassion (T <sub>2</sub> )    | -0.41 | -0.32 | -0.34 | -0.37 | 1     |       |       |       |      |      |      |      |
| 6. Self-compassion (T <sub>3</sub> )    | -0.34 | -0.38 | -0.37 | -0.38 | 0.62  | 1     |       |       |      |      |      |      |
| 7. Self-compassion (T <sub>4</sub> )    | -0.36 | -0.34 | -0.39 | -0.39 | 0.62  | 0.68  | 1     |       |      |      |      |      |
| 8. Self-compassion (T <sub>5</sub> )    | -0.30 | -0.30 | -0.32 | -0.42 | 0.55  | 0.60  | 0.64  | 1     |      |      |      |      |
| 9. NSSI (T <sub>2</sub> )               | 0.19  | 0.08  | 0.12  | 0.14  | -0.16 | -0.10 | -0.08 | -0.09 | 1    |      |      |      |
| 10. NSSI (T <sub>3</sub> )              | 0.10  | 0.19  | 0.14  | 0.13  | -0.11 | -0.16 | -0.08 | -0.09 | 0.28 | 1    |      |      |
| 11. NSSI (T <sub>4</sub> )              | 0.10  | 0.14  | 0.22  | 0.15  | -0.10 | -0.12 | -0.13 | -0.10 | 0.23 | 0.24 | 1    |      |
| 12. NSSI (T <sub>5</sub> )              | 0.12  | 0.12  | 0.14  | 0.24  | -0.12 | -0.13 | -0.14 | -0.15 | 0.19 | 0.19 | 0.28 | 1    |
| Mean                                    | 16.25 | 13.85 | 13.91 | 15.76 | 40.28 | 40.82 | 40.79 | 40.41 | 0.38 | 0.41 | 0.38 | 0.80 |
| SD                                      | 5.68  | 4.00  | 4.07  | 5.72  | 6.21  | 6.39  | 6.44  | 6.49  | 1.94 | 2.30 | 2.15 | 3.55 |

**Note:** All correlation coefficients are significant at 0.001 (two-tailed). NSSI = Non-suicidal self-injury.

### The Results of Cross-Lagged Panel Models

After controlling for gender, age and FES, the first CLPM was conducted to test the association between sleep disturbances and NSSI. The result showed that the model fitted the data well,  $\chi^2 = 454.56$ ,  $df=12$ ,  $p < 0.001$ , CFI = 0.92, SRMR = 0.06, and RMSEA = 0.071. As depicted in Figure 3, all the auto-regressive paths for sleep disturbances and NSSI were significant. For the cross-lagged paths, sleep disturbances at prior time points predicted NSSI at subsequent time points but not vice versa. These results indicated that sleep disturbances may have a greater impact on subsequent NSSI.

In the second CLPM, we added self-compassion to the first model as a possible mediator. The result showed that the model fitted the data best,  $\chi^2 = 984.15$ ,  $df=27$ ,  $p < 0.001$ , CFI = 0.93, SRMR = 0.062, and RMSEA = 0.061. As depicted in Figure 4, all the auto-regressive paths were significant. Analyses of indirect effects revealed a significant indirect path from sleep disturbances to NSSI through self-compassion over time (see Table 3). More specifically, the path from sleep disturbances at T<sub>2</sub> to NSSI at T<sub>4</sub> via self-compassion at T<sub>3</sub> was significant (indirect effect = 0.007, 95% CI = 0.004–0.011); and the path from



**Figure 2** The prevalence of non-suicidal self-injury among college students.



**Table 2** Fit Indices for Measurement Invariance of Sleep Disturbances, Self-Compassion and Non-Suicidal Self-Injury

| Variables                | Model Tested     | $\chi^2$        | df         | CFI          | TLI          | RMSEA        | SRMR         | $\Delta$ CFI  | $\Delta$ RMSEA | $\Delta$ SRMR |
|--------------------------|------------------|-----------------|------------|--------------|--------------|--------------|--------------|---------------|----------------|---------------|
| Sleep disturbances       | Configural MI    | 1171.203        | 188        | 0.977        | 0.966        | 0.035        | 0.035        |               |                |               |
|                          | <b>Metric MI</b> | <b>1317.749</b> | <b>200</b> | <b>0.974</b> | <b>0.964</b> | <b>0.036</b> | <b>0.042</b> | <b>-0.003</b> | <b>0.001</b>   | <b>0.007</b>  |
|                          | Scalar MI        | 4758.488        | 218        | 0.893        | 0.865        | 0.070        | 0.170        | -0.081        | 0.034          | 0.128         |
| Self-compassion          | Configural MI    | 8241.925        | 732        | 0.943        | 0.912        | 0.050        | 0.054        |               |                |               |
|                          | Metric MI        | 8278.493        | 750        | 0.943        | 0.914        | 0.049        | 0.054        | 0             | -0.001         | 0             |
|                          | <b>Scalar MI</b> | <b>8664.897</b> | <b>786</b> | <b>0.940</b> | <b>0.914</b> | <b>0.049</b> | <b>0.055</b> | <b>-0.003</b> | <b>0</b>       | <b>0.001</b>  |
| Non-suicidal self-injury | Configural MI    | 7455.807        | 302        | 0.916        | 0.894        | 0.075        | 0.037        |               |                |               |
|                          | Metric MI        | 8774.571        | 320        | 0.910        | 0.890        | 0.077        | 0.042        | -0.006        | 0.002          | 0.005         |
|                          | <b>Scalar MI</b> | <b>8943.120</b> | <b>341</b> | <b>0.905</b> | <b>0.888</b> | <b>0.077</b> | <b>0.044</b> | <b>-0.005</b> | <b>0</b>       | <b>0.002</b>  |

**Note:** Bold type indicates established model of measurement invariance.

sleep disturbances at T<sub>3</sub> to NSSI at T<sub>5</sub> via self-compassion at T<sub>4</sub> was significant (indirect effect = 0.009, 95% CI = 0.006–0.013). Additionally, bidirectional relationships between sleep disturbances and self-compassion were also found.

## Gender Invariance Analyses

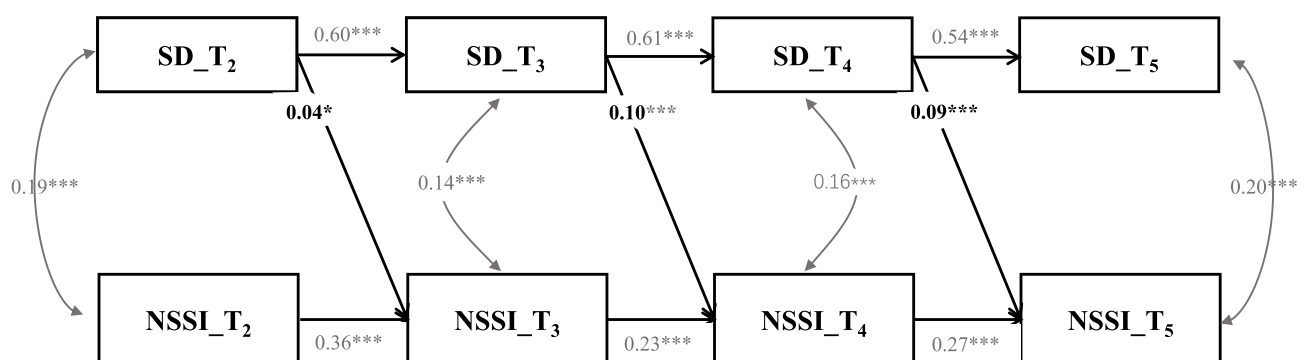
A multi-group approach was adopted to test invariance across gender, and the results suggested that these associations did not have significant gender differences. Therefore, gender did not moderate the relationships among the three variables.

## Discussion

The current study is the first to use the cross-lagged panel models (CLPMs) to more thoroughly and rigorously examine the longitudinal relationship between sleep disturbances and NSSI, and the mediating role of self-compassion in a large sample of college students. The main results are as follows: 1) prior sleep disturbances predicted subsequent NSSI after adjusting for covariates; 2) self-compassion mediated the longitudinal relationship between sleep disturbances and NSSI after adjusting for covariates; 3) there is a bidirectional and negative effect between sleep disturbances and self-compassion.

## The Prevalence Rates of NSSI

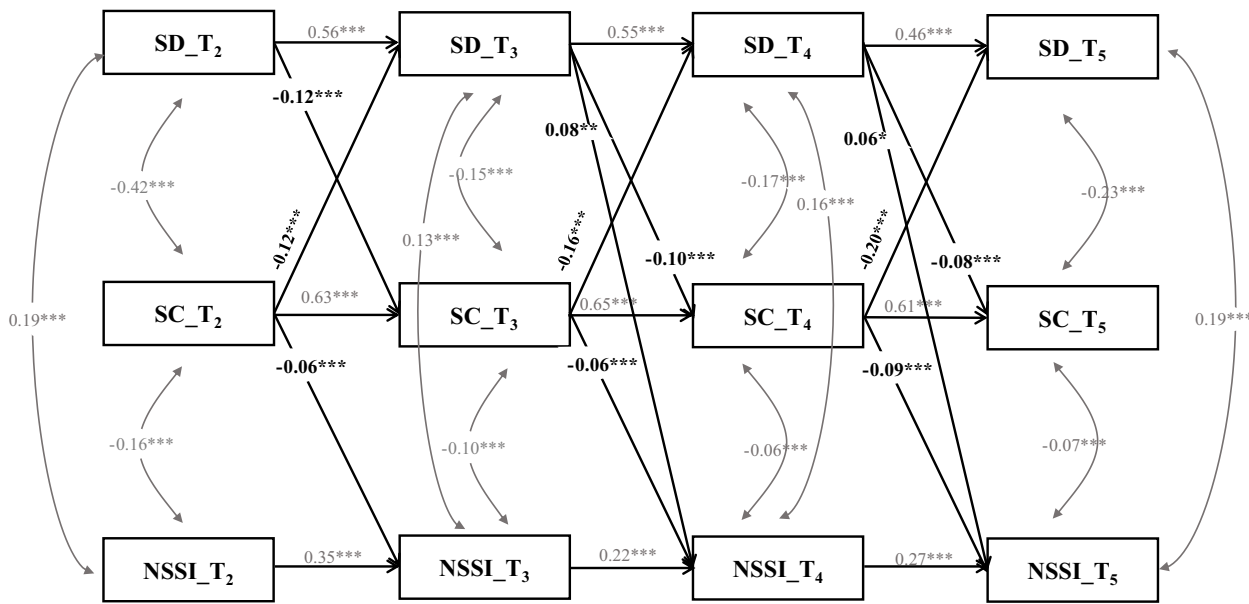
The overall prevalence of NSSI among college students varies from 7.2% to 10.2% across different time points, with 5.1–6.7% of students reporting sporadic NSSI and 2.1–4.9% reporting repetitive NSSI, which is consistent with some previous studies.<sup>8,51,52</sup> For instance, using data from the Leuven College Surveys, Kiekens et al found that a one-year incidence of first onset NSSI was 10.3%, with a total of 8.6% of participants reporting sporadic NSSI and 7.0% reporting repetitive NSSI



**Figure 3** Cross-Lagged Panel Model for sleep disturbances and non-suicidal self-injury.

**Note:** \* $p < 0.05$ ; \*\*\* $p < 0.001$ .

**Abbreviations:** SD, Sleep disturbances; NSSI, non-suicidal self-injury.



**Figure 4** Cross-Lagged Panel Model for sleep disturbances, self-compassion, and non-suicidal self-injury.

**Note:** \* $p < 0.05$ \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ .

**Abbreviations:** SD, Sleep disturbances; SC, self-compassion; NSSI, non-suicidal self-injury.

during the first two years of college.<sup>8</sup> However, some studies found higher or lower prevalence of NSSI compared with our results.<sup>3,53,54</sup> These variations may be influenced by factors such as cultural and socioeconomic differences, as well as variations in screening methods, sample characteristics, and timeframe used to estimate prevalence (lifetime, last year, or last month).<sup>52</sup>

### The Mediating Role of Self-Compassion Between Sleep Disturbances and NSSI

As a crucial strategy for emotional regulation, self-compassion was incorporated into the cross-lagged mediation model to explore its potential mediating role between sleep disturbances and NSSI. Our hypothesis was supported showing that self-compassion indeed played a longitudinal mediating role in linking sleep disturbances and NSSI. More specifically, individuals with more severe sleep disturbances tended to have lower levels of self-compassion, thereby increasing their risk of engaging in NSSI. These findings extended the literature that has identified self-compassion as a mediator between negative life events (eg, peer victimization and traumatic stress) and self-injury (or other psychological maladjustment).<sup>37–39,55</sup>

On the one hand, we found that sleep disturbances were negatively predictive of self-compassion. This aligns with the principles of Compassion-focused therapy (CFT), which proposes that individuals have three affect-regulating systems: 1) the threat system (functions to protect individuals from harm), 2) the drive system (functions to seek resources and achieve goals), and 3) the soothing system (functions to promote rest and digest, ease, and calmness).<sup>56</sup> Based on this model, stressful life events, such as chronic sleep disturbances, may trigger a defense response through the threat system,

**Table 3** Significant Indirect Paths Between Sleep Disturbances, Self-Compassion, and NSSI for the Final CLPM

| Indirect Effects   | $\beta$  | SE    | Bootstrapped 95% CI |       |
|--|----------|-------|---------------------|-------|
|  |          |       | Lower               | Upper |
| SD T <sub>2</sub> → SCT <sub>3</sub> → NSSI T <sub>4</sub> | 0.007*** | 0.002 | 0.004               | 0.011 |
| SD T <sub>3</sub> → SCT <sub>4</sub> → NSSI T <sub>5</sub> | 0.009*** | 0.002 | 0.006               | 0.013 |

**Note:** \*\*\* $p < 0.001$ . Standardized coefficients.

**Abbreviations:** NSSI, Non-suicidal self-injury; T, Time. are presented, CLPM, Cross-Lagged Panel Model; SD, Sleep disturbances; SC, Self-compassion.



thereby disrupting their soothing system. Consequently, individuals experiencing sleep disturbances may struggle to show compassion towards their own distress and utilize compassionate self-regulation skills.<sup>25</sup> In addition, self-compassion is believed to encompass the ability to perceive life experiences more “objectively”.<sup>57</sup> Individuals with sleep disturbances, in contrast to those without, often exhibit negative cognition,<sup>58</sup> such as self-criticism and catastrophic thoughts. These negative thought patterns may undermine an individual’s capacity to provide themselves with emotional care.<sup>27,57</sup> On the other hand, our results suggested that self-compassion had a longitudinal effect on NSSI, which was consistent with previous cross-sectional<sup>31–33</sup> and longitudinal studies.<sup>55,59</sup> Several possible explanations can be proposed for these associations. Firstly, according to the benefits and barriers model of NSSI,<sup>29</sup> people have to overcome several instinctive “barriers” before experiencing the “benefits” of NSSI. Having a positive self-view (eg, self-compassion) may create an environment where it is difficult to deliberately self-injure because individuals with high levels of self-compassion may view themselves favorably and have a protective attitude towards their bodies, making it less likely for them to engage in self-injury as a means of coping with negative emotions.<sup>32</sup> When the “barrier” of a positive self-view is weakened, individuals may start to believe that they deserve pain and punishment, leading to a stronger identification with NSSI.<sup>30,60</sup> Secondly, the social mentality theory of self-compassion and self-reassurance posit that self-compassion can enhance individuals’ ability to seek support and assistance from others.<sup>61</sup> Therefore, individuals with higher levels of self-compassion may be more likely to communicate their need for help and respond positively to support from others.<sup>59</sup> As a result, others may be more willing to provide additional support, leading to a greater sense of social support, which may prevent the occurrence of NSSI. Thirdly, previous research has found a positive association between self-compassion and adaptive coping, as well as a negative correlation with maladaptive coping.<sup>34</sup> Maladaptive coping strategies have been shown to be associated with NSSI.<sup>36,62</sup> Overall, self-compassion may be a potential mediating mechanism linking sleep disturbances and NSSI.

## The Bidirectional Relationship Between Sleep Disturbances and Self-Compassion

Our results suggested a bidirectional relationship between sleep disturbances and self-compassion, which was consistent with previous empirical research.<sup>25,63–65</sup> The predictive effects of sleep disturbances on self-compassion have been discussed earlier. This section focuses on the predictive effect of self-compassion on sleep disturbances. Self-compassion can contribute to nighttime relaxation, but self-critical thoughts may fuel restlessness and agitation, leading to poorer sleep quality. Emerging studies have suggested that self-compassion may play a protective role in ameliorating the negative effects of stressors on sleep quality.<sup>63,64</sup> In addition, self-compassion-based interventions have shown effectiveness in improving sleep quality. For instance, in an experiment conducted by Butz and Stahlberg,<sup>65</sup> compared to students in the control group, those in the self-compassion intervention groups (a 20-min brief self-compassion meditation vs a self-compassionate writing task) reported significantly better sleep quality. In short, self-compassion is amenable and that improved self-compassion can promote better sleep quality.

## Strengths and Limitations

Compared to previous cross-sectional designs or shorter-term longitudinal studies, this study used a large-sample longitudinal design to comprehensively examine the temporal associations between sleep disturbances, self-compassion, and NSSI from a developmental perspective. Although this study contributes to the literature, the findings need to be interpreted with consideration of several limitations. First, all data were assessed by self-report measures, which may be affected by social desirability and recall bias. Structured diagnostic interviews and behavioral measures should be used in future studies to provide a comprehensive understanding of the variables under investigation. Second, due to data fitting, random intercept cross-lagged panel models (RI-CLPMs) were not used in this study. This means that we did not disentangle between-person variance and within-person variance.<sup>66</sup> Future studies could use RI-CLPMs to explore longitudinal relationships between the aforementioned variables at the within-person level. Third, we used a convenience sample of college students in the southern provinces of China, which made it difficult to generalize our findings to other regions or cultural contexts. Future studies in a larger and more diverse samples would help to enhance the external validity of our findings. Finally, the validity of the SCS as a measure of self-compassion has long been debated. The SCS scale measures both positive and negative components simultaneously. Thus, there is a growing trend to separate the SCS

into two independent factors in research. However, Neff indicated that self-compassion represents movement along a continuum from uncompassionate self-responding to compassionate self-responding, and separating the SCS into two separate factors is problematic.<sup>26</sup>

## Clinical Implications

From a practical perspective, these findings indicated that clinicians and school counselors should incorporate the assessment and intervention of sleep disturbances, self-compassion, and NSSI into their practice. Psychological interventions aimed at improving sleep quality, such as cognitive-behavioral therapy (CBT) and dialectical behavioral therapy (DBT), could be considered.<sup>67,68</sup> In addition, self-compassion-oriented prevention and intervention programs, such as compassion-focused therapy (CFT) and mindful self-compassion (MSC), may hold great promise in reducing the incidence of NSSI.<sup>64,69</sup> Meta-analyses have shown that self-compassion interventions are effective in promoting self-compassion and reducing psychopathology in clinical and subclinical populations.<sup>70</sup> Therefore, schools and mental health professionals should encourage college students who are experiencing sleep problems to participate in self-compassion courses.

## Conclusion

The current study utilized CLPMs to theoretically test the longitudinal dynamic relationships between these variables. The results revealed a bidirectional association between sleep disturbances and self-compassion, with self-compassion mediated the association between sleep disturbances and NSSI.

## Data Sharing Statement

The data are not publicly available due to privacy and research ethical restrictions.

## Statement of Ethics

This study complies with the Declaration of Helsinki. The present study protocol was reviewed and approved by the Research Ethics Committee of Hebei University.

## Informed Consent Statement

All participants provided written informed consent prior to their study enrolment.

## Acknowledgments

We thank all the project participants in this study.

## Funding

This study was supported from the Open Experimental Project of Hebei University (Grant No. sy202201), and Higher Education Teaching Reform Project of Hebei Province (Grant No. 2021GJJG684).

## Disclosure

The authors declare no conflicts of interest in this work.

---

## References

1. Klonsky ED. Non-suicidal self-injury in United States adults: prevalence, sociodemographics, topography and functions. *Psychol Med*. 2011;41(9):1981–1986. doi:10.1017/s0033291710002497
2. Taylor PJ, Jomar K, Dhingra K, Forrester R, Shahmalak U, Dickson JM. A meta-analysis of the prevalence of different functions of non-suicidal self-injury. *J Affect Disord*. 2018;227:759–769. doi:10.1016/j.jad.2017.11.073
3. Whitlock J, Muehlenkamp J, Purington A, et al. Nonsuicidal self-injury in a college population: general trends and sex differences. *J Am Coll Health*. 2011;59(8):691–698. doi:10.1080/07448481.2010.529626
4. Nock MK. Self-injury. *Annu Rev Clin Psycho*. 2010;6(1):339–363. doi:10.1146/annurev.clinpsy.121208.131258
5. Buelens T, Luyckx K, Kiekens G, Gandhi A, Muehlenkamp JJ, Claes L. Investigating the DSM-5 criteria for non-suicidal self-injury disorder in a community sample of adolescents. *J Affect Disord*. 2020;260:314–322. doi:10.1016/j.jad.2019.09.009

6. Zetterqvist M, Lundh LG, Dahlström Ö, Svedin CG. Prevalence and function of non-suicidal self-injury (NSSI) in a community sample of adolescents, using suggested DSM-5 criteria for a potential NSSI disorder. *J Abnorm Child Psych.* 2013;41(5):759–773. doi:10.1007/s10802-013-9712-5
7. Alonso J, Auerbach RP, Bantjes J, et al. Non-suicidal self-injury among first-year college students and its association with mental disorders: results from the world mental health international college student (WMH-ICS) initiative. *Psychol Med.* 2021;53(3):875–886. doi:10.1017/S0033291721002245
8. Kiekens G, Hasking P, Claes L, et al. Predicting the incidence of non-suicidal self-injury in college students. *Eur Psychiat.* 2020;59:44–51. doi:10.1016/j.eurpsy.2019.04.002
9. Kiekens G, Claes L, Hasking P, et al. A longitudinal investigation of non-suicidal self-injury persistence patterns, risk factors, and clinical outcomes during the college period. *Psychol Med.* 2023;53:6011–6026. doi:10.1017/s0033291722003178
10. Kiekens G, Claes L, Demyttenaere K, et al. Lifetime and 12-month nonsuicidal self-injury and academic performance in college freshmen. *Suicide Life-Threat.* 2016;46(5):563–576. doi:10.1111/sltb.12237
11. Bentley KH, Cassiello-Robbins CF, Vittorio L, Sauer-Zavala S, Barlow DH. The association between nonsuicidal self-injury and the emotional disorders: a meta-analytic review. *Clin Psychol Rev.* 2015;37:72–88. doi:10.1016/j.cpr.2015.02.006
12. Paul E, Tsypes A, Eidlitz L, Ernhout C, Whitlock J. Frequency and functions of non-suicidal self-injury: associations with suicidal thoughts and behaviors. *Psychiat Res.* 2015;225(3):276–282. doi:10.1016/j.psychres.2014.12.026
13. Becker SP, Jarrett MA, Luebbe AM, Garner AA, Burns GL, Kofler MJ. Sleep in a large, multi-university sample of college students: sleep problem prevalence, sex differences, and mental health correlates. *Sleep Health.* 2018;4(2):174–181. doi:10.1016/j.sleh.2018.01.001
14. Jiang X, Zheng X, Yang J, et al. A systematic review of studies on the prevalence of Insomnia in university students. *Public Health.* 2015;129(12):1579–1584. doi:10.1016/j.puhe.2015.07.030
15. Russell K, Allan S, Beattie L, Bohan J, MacMahon K, Rasmussen S. Sleep problem, suicide and self-harm in university students: a systematic review. *Sleep Med Rev.* 2019;44:58–69. doi:10.1016/j.smrv.2018.12.008
16. Burke TA, Hamilton JL, Seigel D, et al. Sleep irregularity and nonsuicidal self-injurious urges and behaviors. *Sleep.* 2022;45(zsac084). doi:10.1093/sleep/zsac084
17. Latina D, Bauducco S, Tilton-Weaver L. Insomnia symptoms and non-suicidal self-injury in adolescence: understanding temporal relations and mechanisms. *J Sleep Res.* 2021;30:e13190. doi:10.1111/jsr.13190
18. Bandel SL, Brausch AM. Poor sleep associates with recent non-suicidal self-injury engagement in adolescents. *Behav Sleep Med.* 2020;18(1):81–90. doi:10.1080/15402002.2018.1545652
19. Khazaie H, Zakiei A, McCall WV, et al. Relationship between sleep problems and self-injury: a systematic review. *Behav Sleep Med.* 2021;19(5):689–704. doi:10.1080/15402002.2020.1822360
20. Asarnow JR, Bai S, Babeva KN, et al. Sleep in youth with repeated self-harm and high suicidality: does sleep predict self-harm risk? *Suicide Life-Threat.* 2020;50(6):1189–1197. doi:10.1111/sltb.12658
21. Neff KD. The development and validation of a scale to measure self-compassion. *Self Identity.* 2003;2(3):223–250. doi:10.1080/15298860309027
22. Zhang H, Li J, Sun B, Wei Q. Effects of childhood maltreatment on self-compassion: a systematic review and meta-analysis. *Trauma Violence Abuse.* 2021;24(2):873–885. doi:10.1177/15248380211043825
23. Miron LR, Seligowski AV, Boykin DM, Orcutt HK. The potential indirect effect of childhood abuse on posttrauma pathology through self-compassion and fear of self-compassion. *Mindfulness.* 2016;7(3):596–605. doi:10.1007/s12671-016-0493-0
24. Zhang H, Chi P, Long H, Ren X. Bullying victimization and depression among left-behind children in rural China: roles of self-compassion and hope. *Child Abuse Neglect.* 2019;96:104072. doi:10.1016/j.chiabu.2019.104072
25. Kim JJ, Oldham M, Fernando AT, Kirby JN. Compassion mediates poor sleep quality and mental health outcomes. *Mindfulness.* 2021;12(5):1252–1261. doi:10.1007/s12671-021-01595-8
26. Neff KD. Self-compassion: theory, method, research, and intervention. *Annu Rev Psycho.* 2023;74(1):193–218. doi:10.1146/annurev-psych-032420-031047
27. Neff KD. Self-compassion, self-esteem, and well-being. *Soc Personal Psychol Compass.* 2011;5(1):1–12. doi:10.1111/j.1751-9004.2010.00330.x
28. Neff KD, Rude SS, Kirkpatrick KL. An examination of self-compassion in relation to positive psychological functioning and personality traits. *J Res Pers.* 2007;41(4):908–916. doi:10.1016/j.jrp.2006.08.002
29. Hooley JM, Franklin JC. Why do people hurt themselves? A new conceptual model of nonsuicidal self-injury. *Clin Psychol Sci.* 2017;6(3):428–451. doi:10.1177/2167702617745641
30. Xavier A, Pinto Gouveia J, Cunha M. Non-suicidal self-injury in adolescence: the role of shame, self-criticism and fear of self-compassion. *Child Youth Care For.* 2016;45(4):571–586. doi:10.1007/s10566-016-9346-1
31. Xavier A, Pinto Gouveia J, Cunha M. The protective role of self-compassion on risk factors for non-suicidal self-injury in adolescence. *Sch Ment Health.* 2016;8(4):476–485. doi:10.1007/s12310-016-9197-9
32. Cleare S, Gumley A, O'Connor RC. Self-compassion, self-forgiveness, suicidal ideation, and self-harm: a systematic review. *Clin Psychol Psychot.* 2019;26(5):511–530. doi:10.1002/cpp.2372
33. Per M, Schmelefske E, Brophy K, Austin SB, Khoury B. Mindfulness, self-compassion, self-injury, and suicidal thoughts and behaviors: a correlational meta-analysis. *Mindfulness.* 2022;13(4):821–842. doi:10.1007/s12671-021-01815-1
34. Ewert C, Vater A, Schröder-Abé M. Self-compassion and coping: a meta-analysis. *Mindfulness.* 2021;12(5):1063–1077. doi:10.1007/s12671-020-01563-8
35. Allen AB, Leary MR. Self-compassion, stress, and coping. *Soc Personal Psychol Compass.* 2010;4(2):107–118. doi:10.1111/j.1751-9004.2009.00246.x
36. Wan Y, Chen R, Wang S, et al. Associations of coping styles with nonsuicidal self-injury in adolescents: do they vary with gender and adverse childhood experiences? *Child Abuse Neglect.* 2020;104:104470. doi:10.1016/j.chiabu.2020.104470
37. Játiva R, Cerezo MA. The mediating role of self-compassion in the relationship between victimization and psychological maladjustment in a sample of adolescents. *Child Abuse Neglect.* 2014;38(7):1180–1190. doi:10.1016/j.chiabu.2014.04.005
38. Múzquiz J, Pérez-García AM, Bermúdez J. Relationship between direct and relational bullying and emotional well-being among adolescents: the role of self-compassion. *Curr Psychol.* 2023;42(18):15874–15882. doi:10.1007/s12144-022-02924-3

39. Chang EC, Yu T, Najarian ASM, et al. Understanding the association between negative life events and suicidal risk in college students: examining self-compassion as a potential mediator. *J Clin Psychol*. 2017;73(6):745–755. doi:10.1002/jclp.22374
40. Goodman JS, Blum TC. Assessing the non-random sampling effects of subject attrition in longitudinal research. *J Manage*. 1996;22:627–652. doi:10.1016/s0149-2063(96)90027-6
41. Allison PD. Missing data techniques for structural equation modeling. *J Abnorm Psychol*. 2003;112(4):545–557. doi:10.1037/0021-843x.112.4.545
42. Liu X, Yang Y, Liu Z, Luo Y, Fan F, Jia C. Psychometric properties of youth self-rating insomnia scale (YSIS) in Chinese adolescents. *Sleep Biol Rhythms*. 2019;17(3):339–348. doi:10.1007/s41105-019-00222-3
43. Zhang Y, Wang D, Zhao J, et al. Insomnia and other sleep-related problems during the remission period of the COVID-19 pandemic: a large-scale survey among college students in China. *Psychiat Res*. 2021;304:114153. doi:10.1016/j.psychres.2021.114153
44. Chi X, Liang K, Chen S-T, et al. Mental health problems among Chinese adolescents during the COVID-19: the importance of nutrition and physical activity. *Int J Clin Hlth Psyc*. 2021;21(3):100218. doi:10.1016/j.ijchp.2020.100218
45. Raes F, Pommier E, Neff KD, Van Gucht D. Construction and factorial validation of a short form of the self-compassion scale. *Clin Psychol Psychot*. 2011;18(3):250–255. doi:10.1002/cpp.702
46. Huang L, Chi P, Wang E, Bu H, Chi X. Trajectories of complex posttraumatic stress symptoms among Chinese college students with childhood adversities: the role of self-compassion. *Child Abuse Neglect*. 2023;150:106138. doi:10.1016/j.chiabu.2023.106138
47. Gratz KL. Measurement of deliberate self-harm: preliminary data on the deliberate self-harm inventory. *J Psychopathol Behav Assess*. 2001;23(4):253–263. doi:10.1023/A:1012779403943
48. Liu S, You J, Ying J, Li X, Shi Q. Emotion reactivity, nonsuicidal self-injury, and regulatory emotional self-efficacy: a moderated mediation model of suicide ideation. *J Affect Disord*. 2020;266:82–89. doi:10.1016/j.jad.2020.01.083
49. Gao Q, Guo J, Wu H, Huang J, Wu N, You J. Different profiles with multiple risk factors of nonsuicidal self-injury and their transitions during adolescence: a person-centered analysis. *J Affect Disord*. 2021;295:63–71. doi:10.1016/j.jad.2021.08.004
50. Chen FF. Sensitivity of goodness of fit indexes to lack of measurement invariance. *Struct Equation Model*. 2007;14(3):464–504. doi:10.1080/10705510701301834
51. Qu D, Wen X, Liu B, et al. Non-suicidal self-injury in Chinese population: a scoping review of prevalence, method, risk factors and preventive interventions. *Lancet Reg Health-Western Pac*. 2023;37:1–19. doi:10.1016/j.lanwpc.2023.100794
52. Swannell SV, Martin GE, Page A, Hasking P, St John NJ. Prevalence of nonsuicidal self-injury in nonclinical samples: systematic review, meta-analysis and meta-regression. *Suicide Life-Threat*. 2014;44(3):273–303. doi:10.1111/sltb.12070
53. Kiekens G, Hasking P, Boyes M, et al. The associations between non-suicidal self-injury and first onset suicidal thoughts and behaviors. *J Affect Disord*. 2018;239:171–179. doi:10.1016/j.jad.2018.06.033
54. Taliaferro LA, Muehlenkamp JJ. Risk factors associated with self-injurious behavior among a national sample of undergraduate college students. *J Am Coll Health*. 2015;63(1):40–48. doi:10.1080/07448481.2014.953166
55. Boyne H, Hamza CA. Depressive symptoms, perceived stress, self-compassion and nonsuicidal self-injury among emerging adults: an examination of the between and within-person associations over time. *Emerg Adulthood*. 2021;10(5):1269–1285. doi:10.1177/21676968211029768
56. Gilbert P. The origins and nature of compassion focused therapy. *Brit J Clin Psychol*. 2014;53(1):6–41. doi:10.1111/bjc.12043
57. Neff KD. Self-compassion: an alternative conceptualization of a healthy attitude toward oneself. *Self Identity*. 2003;2(2):85–101. doi:10.1080/15298860309032
58. Ballesio A, Bacaro V, Vacca M, et al. Does cognitive behaviour therapy for insomnia reduce repetitive negative thinking and sleep-related worry beliefs? A systematic review and meta-analysis. *Sleep Med Rev*. 2021;55:101378. doi:10.1016/j.smr.2020.101378
59. Yang Q, Xie R, Li J, Zhang R, Ding W, Li W. The mutual relationship between self-compassion, perceived social support, and adolescent NSSI: a three-wave longitudinal study. *Mindfulness*. 2023;14(8):1940–1950. doi:10.1007/s12671-023-02169-6
60. Hooley JM, St Germain SA. Nonsuicidal self-injury, pain, and self-criticism: does changing self-worth change pain endurance in people who engage in self-injury? *Clin Psychol Sci*. 2014;2(3):297–305. doi:10.1177/2167702613509372
61. Hermanto N, Zuroff DC. The social mentality theory of self-compassion and self-reassurance: the interactive effect of care-seeking and caregiving. *J Soc Psychol*. 2016;156(5):523–535. doi:10.1080/00224545.2015.1135779
62. Cawood CD, Huprich SK. Late adolescent nonsuicidal self-injury: the roles of coping style, self-esteem, and personality pathology. *J Pers Disord*. 2011;25(6):765–781. doi:10.1521/pedi.2011.25.6.765
63. Hu Y, Wang Y, Sun Y, Arteta-Garcia J, Puroil S. Diary study: the protective role of self-compassion on stress-related poor sleep quality. *Mindfulness*. 2018;9(6):1931–1940. doi:10.1007/s12671-018-0939-7
64. Butz S, Stahlberg D. Can self-compassion improve sleep quality via reduced rumination? *Self Identity*. 2018;17(6):666–686. doi:10.1080/15298868.2018.1456482
65. Brown L, Houston EE, Amonoo HL, Bryant C. Is self-compassion associated with sleep quality? A meta-analysis. *Mindfulness*. 2021;12(1):82–91. doi:10.1007/s12671-020-01498-0
66. Hamaker EL, Kuiper RM, Grasman RPPP. A critique of the cross-lagged panel model. *Psychol Methods*. 2015;20(1):102–116. doi:10.1037/a0038889
67. Calvo N, García-González S, Perez-Galbarro C, et al. Psychotherapeutic interventions specifically developed for NSSI in adolescence: a systematic review. *Eur Neuropsychopharm*. 2022;58:86–98. doi:10.1016/j.euroneuro.2022.02.009
68. Turner BJ, Austin SB, Chapman AL. Treating nonsuicidal self-injury: a systematic review of psychological and pharmacological interventions. *Can J Psychiat*. 2014;59(11):576–585. doi:10.1177/070674371405901103
69. Hasking P. Self-compassion and non-suicidal self-injury. In: Finlay-Jones A, Bluth K, Neff K, editors. *Handbook of Self-Compassion*. Cham: Springer International Publishing; 2023:369–378.
70. Wilson AC, Mackintosh K, Power K, Chan SWY. Effectiveness of self-compassion related therapies: a systematic review and meta-analysis. *Mindfulness*. 2019;10(6):979–995. doi:10.1007/s12671-018-1037-6

Nature and Science of Sleep

Dovepress

### Publish your work in this journal

Nature and Science of Sleep is an international, peer-reviewed, open access journal covering all aspects of sleep science and sleep medicine, including the neurophysiology and functions of sleep, the genetics of sleep, sleep and society, biological rhythms, dreaming, sleep disorders and therapy, and strategies to optimize healthy sleep. The manuscript management system is completely online and includes a very quick and fair peer-review system, which is all easy to use. Visit <http://www.dovepress.com/testimonials.php> to read real quotes from published authors.

Submit your manuscript here: <https://www.dovepress.com/nature-and-science-of-sleep-journal>