



Positive mental health accounts for the relationship between insomnia symptoms and suicide-related outcomes

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ABSTRACT

Insomnia symptoms have been shown to be associated with suicide ideation/behavior. However, the underlying mechanism is unclear and studies on protective factors that might mitigate the association between sleep-related problems and suicide ideation/behavior are largely missing. On this background the aim of the current study was to investigate, whether positive mental health (PMH) accounts for the association between insomnia symptoms and suicidal ideation/behavior. A total of 913 participants (72.2% women; age: $M (SD) = 25.91 (7.08)$) completed measures on insomnia symptoms, PMH and suicide ideation/behavior via an online survey. The results reveal a significant association between insomnia symptoms and PMH. Both variables were significantly linked to lifetime suicide ideation/behavior and 12-month suicide ideation. Moreover, the association between insomnia symptoms and suicide-related outcomes was significantly mitigated by PMH. The current findings complement previous studies on the association between insomnia symptoms and suicide ideation/behavior. Furthermore, they demonstrate that PMH can mitigate the risk of suicide-related outcomes. Therapeutic intervention targeting insomnia symptoms and fostering PMH might be useful in the prevention of suicide ideation/behavior.

1. Introduction

Insomnia is a major public health concern. Rates of insomnia in the general population are between 5 and 19% (Riemann et al., 2017), with about one third of the adult German population suffering from insomnia symptoms at any given moment (Schlack et al., 2013). Insomnia is a special problem among university students (Jiang et al., 2015), as such about 19.5% of students are reported to suffer from insomnia symptoms. Insomnia negatively impacts mental health and quality of life (Sivertsen et al., 2009, 2021; Zhang et al., 2022) and a growing body of research has also uncovered a link between sleep disturbances and suicide: Sleep disorders (including insomnia, nightmares and hypersomnia) as well as general sleep complaints are linked to greater levels of suicidal ideation, suicide attempts and suicide (Harris et al., 2020; Liu et al., 2019, 2020; Miller and McCall, 2023) – both in cross-sectional and longitudinal studies. Furthermore, sleep problems are seen as acute warning signs of suicide within recent attempts of defining acute suicidal states (Galynker, 2017; Tucker et al., 2016). Finally, preliminary evidence suggests that improvements in sleep may therapeutically impact suicidal

ideation (Bishop et al., 2020; Trockel et al., 2015).

It is hypothesized that insomnia might influence suicide-related thoughts and behaviors indirectly through its effects on specific biological (e.g., inflammation, circadian system), psychological (e.g., mood dysregulation, hopelessness), and cognitive (e.g., cognitive deficits) variables (Dolsen et al., 2021; Woznica et al., 2015). However, the exact mechanisms are unclear and studies on protective factors that might mitigate the association between sleep-related problems and suicide ideation/behavior are largely missing. The latter is of special relevance, since sleep problems are on the one hand significantly associated with suicide ideation/behavior, yet, on the other hand this association is of rather small magnitude (Harris et al., 2020) – just as for any other risk factor (Franklin et al., 2017). Therefore, it is of theoretical and clinical interest to investigate factors that might mitigate the impact of sleep problems on suicidality.

Following available literature, one of such factors could be positive mental health (PMH; Lukat et al., 2017). Two broad traditions describe the key components of PMH (Deci and Ryan, 2008): The hedonic tradition deals with positive affect and life satisfaction, the eudaimonic

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tradition focuses on human potential and optimal functioning. Taking both the hedonic and eudaimonic tradition into account, PMH can be defined as the presence of subjective, social and psychological well-being (Suldo and Shaffer, 2008). Therefore, PMH comprises a positive sense of well-being, as well as the capacity to enjoy life and deal with challenges of everyday life (Keyes et al., 2002). It is a resilience factor that contributes to adaptive functioning in stressful situations (cf., Wood and Johnson, 2016). Earlier research showed that PMH accounts for the association between various risk factors (e.g., depression, cyberbullying, entrapment, suicidal ideation) and suicidal outcomes (suicide ideation, suicide ideation/behavior, lifetime suicide attempts; Brailovskaia et al., 2019; Brailovskaia et al., 2018, 2020; Teismann and Brailovskaia, 2020; Teismann et al., 2018b; Teismann et al., 2022). Corresponding effects were shown in both, cross-sectional and longitudinal studies using various samples (e.g., student samples from Germany, China and Iran, psychiatric inpatients). In all of the aforementioned studies, PMH was assessed with the PMH-Scale (Lukat et al., 2016), a unidimensional measure that comprises items on life satisfaction, self-acceptance and self-efficacy (Teismann and Brailovskaia, 2020).

Finally, it was repeatedly demonstrated by empirical research that PMH – as assessed with the PMH-Scale – is not simply the absence of negative mental health/mental health problems (e.g., Barry, 2009; Suldo et al., 2011; Trompetter et al., 2017). Following dual-factor modes of mental health, PMH and mental health problems are two distinct co-existing dimensions (Keyes, 2005; Suldo and Shaffer, 2008). A high level of PMH and a low level of mental health problems describe as state of complete mental health (Trompetter et al., 2017). In this context, available research showed that PMH and suicide ideation are not mutually exclusive but exist simultaneously (Brailovskaia et al., 2022a; Teismann et al., 2018a). Thus, PMH and suicide ideation/behavior should not be understood as opposite poles of a single dimension, but rather as two independent factors of mental health/mental illness (cf., Keyes, 2005).

Taken together, the relevance of PMH as a resilience factor has been demonstrated in an array of studies. However, at present, it is unclear as to how much the association between insomnia symptoms and suicidal ideation/behavior is mitigated by PMH. Insomnia symptoms (Jiang et al., 2015) and suicidal ideation/behavior (Brailovskaia et al., 2021) are highly prevalent especially in young adults, making them a relevant group to focus on. Against this background the aim of the current study was to investigate, whether PMH accounts for the association between insomnia symptoms and lifetime suicidal ideation/behavior and 12-month suicidal ideation in a sample of young adults. A systematic literature search in databases such as PubMed, PsycINFO, and Web of Science indicated that this association has been not investigated so far. We expected PMH to attenuate the influence of insomnia symptoms on suicidal ideation/behavior.

2. Methods and materials

2.1. Procedure and participants

In October 2022, 1237 individuals who study/have studied at a large German university in the Ruhr region were contacted by e-mail that included a participation invitation and a link for the online survey. All of them had previously expressed willingness to be contacted for research investigations. The participation was voluntary and not compensated. There were no specific requirements for participation. Between October and December 2022, 913 persons (72.2% women; age in years: $M(SD) = 25.91(7.08)$, range: 18–73; marital status: 45.3% singles, 43.0% in a romantic relationship, 11.6% married; occupation: 71.0% students, 29.0% employees) completed the survey. The current study has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki). The responsible Ethics Committees approved the conduction of the present study. All participants were

properly instructed and provided their informed consent to participate online. All national regulations and laws regarding human subjects research were followed. The study was conducted in accordance with the Declaration of Helsinki.

2.2. Measures

Insomnia symptoms. We assessed insomnia symptoms with the Insomnia Scale (Pallesen et al., 2019). The three items reflect the core characteristic of insomnia (i.e., problems with sleep onset, problems with sleep maintenance and early morning awakening respectively; e.g., “During the past 12 months, how much have you been bothered by the difficulty to initiate sleep after going to bed?”). The items are rated on a 4-point Likert-type scale (1 = *not bothered*, 4 = *seriously bothered*; current scale reliability: Cronbach’s $\alpha = .777$). The higher the sum score, the higher the insomnia symptoms.

Positive Mental Health. The unidimensional PMH-Scale (Lukat et al., 2016) assessed subjective and psychological aspects of well-being. The nine items (e.g., “I enjoy my life”) are rated on a 4-point Likert-type scale (0 = *do not agree*, 3 = *agree*). Higher sum scores indicate higher levels of PMH. Current internal reliability of the scale was: $\alpha = .918$.

Suicide-related outcomes. We used three items of the Suicidal Behaviors Questionnaire-Revised (SBQ-R; Osman et al., 2001) to measure suicide-related outcomes. Lifetime suicide ideation/behavior was assessed by the Item “Have you ever thought about or attempted to kill yourself?” that was rated on a 6-point Likert-type scale (0 = *never*, 5 = *I have attempted to kill myself, and really hoped to die*); if participants reported lifetime suicide behavior, they were asked how often they attempted suicide in their lifetime; 12-month suicide ideation was assessed by the item “How often have you thought about killing yourself in the past year?” that was rated on a 5-point Likert-type scale (0 = *never*, 1 = *very often (5 or more times)*). The SBQ-R has been recommended for screening purposes (Batterham et al., 2015) and has repeatedly been used in non-clinical and clinical samples (Osman et al., 2001).

2.3. Statistical analyses

Statistical analyses were conducted with SPSS 28 and the macro Process version 4.0 (www.processmacro.org/index.html) (Hayes, 2021). First descriptive statistics and zero-order bivariate correlations between the investigated variables were calculated. Next, following available literature on the buffering effect of PMH (e.g., Brailovskaia et al., 2022b), two indirect effect models (Process: model 4) were run. Both indirect effect models included insomnia symptoms as predictor and PMH as mediator. In the first model, lifetime suicide-related ideation/behavior served as outcome; in the second model, 12-month suicide ideation was included as outcome. Considering the rather young and mostly female composition of our sample, age and gender served as control variables in both models. The basic association between insomnia symptoms and lifetime suicide ideation/behavior/12-month suicide ideation was denoted by c (the total effect). The path of insomnia symptoms to PMH was denoted by a , and the path of PMH to and lifetime suicide ideation/behavior/12-month suicide ideation was denoted by b . The combined effect of path a and path b presented the indirect effect. The direct effect of insomnia symptoms to lifetime suicide ideation/behavior/12-month suicide ideation after inclusion of PMH in the model was denoted by c' . The bootstrapping procedure (10,000 samples) that provides percentile bootstrap confidence intervals (95% CI) assessed the mediation effect. Notably, check tests/sensitivity analyses that included varying constellations of the investigated variables in an indirect effect model were not significant.

3. Results

In total, 82.3% of the sample reported insomnia symptoms (Insomnia

Scale sum >3), 61.6% reported lifetime suicide ideation/behavior (SBQ-R Item 1 > 0), 4.2% reported lifetime suicide attempts and 32.0% reported suicide ideation during the past 12 month (SBQ-R Item 3 > 0). The average number of suicide attempts of those who reported suicide ideation/behavior was $M (SD) = 2.05 (1.79)$; range: 1–10). Lifetime suicide ideation/behavior ($M (SD) = 1.07 (1.18)$, range: 0–5) ($r = .294, p < .001$) and 12-month suicide ideation ($M (SD) = .66 (1.15)$, range: 0–4) ($r = .237, p < .001$) were significantly positively correlated with insomnia symptoms ($M (SD) = 5.71 (2.30)$, range: 3–12). Lifetime suicide ideation/behavior ($r = -.417, p < .001$), 12-month suicide ideation ($r = -.552, p < .001$), and insomnia symptoms ($r = -.379, p < .001$) were significantly negatively correlated with PMH ($M (SD) = 17.50 (5.76)$, range: 0–27).

Both bootstrapped indirect effect models were significant (see Fig. 1). In Model 1, the basic relationship between insomnia symptoms and lifetime suicide ideation/behavior was significant (total effect, $c: p < .001$). After the inclusion of PMH in the model, this relationship was still significant (direct effect, $c': p < .001$). However, the total effect ($b = .151$) was remarkably larger than the direct effect ($b = .082$) (see Fig. 1a). The link between insomnia symptoms and PMH ($a: p < .001$), and the association between PMH and lifetime suicide ideation/behavior ($b: p < .001$) were both significant. The indirect effect (ab) was significant, $b = .068, SE = .009, 95\% CI [.052, .086]$.

In Model 2, the basic relationship between insomnia symptoms and 12-month suicide ideation was significant (total effect, $c: p < .001$). After the inclusion of PMH in the model, this relationship was not significant (direct effect, $c': p = .265$) (see Fig. 1b). The link between insomnia symptoms and PMH ($a: p < .001$), and relationship between PMH and 12-month suicide ideation ($b: p < .001$) were both significant. The indirect effect (ab) was significant, $b = .101, SE = .012, 95\% CI [.080, .125]$.

4. Discussion

The aim of the present study was to examine the mitigating effect of PMH on the association between insomnia symptoms and suicide ideation/behavior. As expected, PMH accounted for the effect of insomnia on both lifetime suicide ideation/behavior and 12-month suicide ideation. PMH thus protects against insomnia symptoms turning into suicidal ideation/behavior. Complementing previous research, the current study shows that insomnia symptoms (Jiang et al., 2015) as well as suicidal ideation/behavior (Brailovskaia et al., 2021) are common in university students and that insomnia symptoms are associated with suicide ideation/behavior (Harris et al., 2020; Liu et al., 2020). Furthermore, the present findings add to a growing body of research highlighting the importance of PMH as a protective and/or resilience factor against suicide ideation/behavior (Boufellous et al., 2023; Brailovskaia et al., 2019). One might speculate that aspects such as self-acceptance and self-efficacy – as assessed with the PMH-Scale – counteract a catastrophizing appraisal of sleep problems. As a consequence, there might not be an increasing build-up of emotional destabilization. On the background of the broaden-and-build-theory (Fredrickson, 2013), one may furthermore speculate that PMH translates into more frequent everyday positive affect (cf., Teismann et al., 2019), which in turn has been shown to help individuals to rebound from adversity (Tugade et al., 2004) and may therefore help to regulate negative emotional experience (including sleep problems). Of note, experimental research has shown that techniques such as loving-kindness meditation can enhance one’s level of PMH (Totzeck et al., 2020). Considering the present findings, future experimental and longitudinal research is recommended to include such techniques in the treatment of persons with sleep problems to assess whether this can reduce the emotional destabilization, decrease negative emotions, enhance positive emotions, and mitigate the risk for suicide-related outcomes. For example, a group of persons with sleep problems could be divided into an intervention group and a waiting control group. The

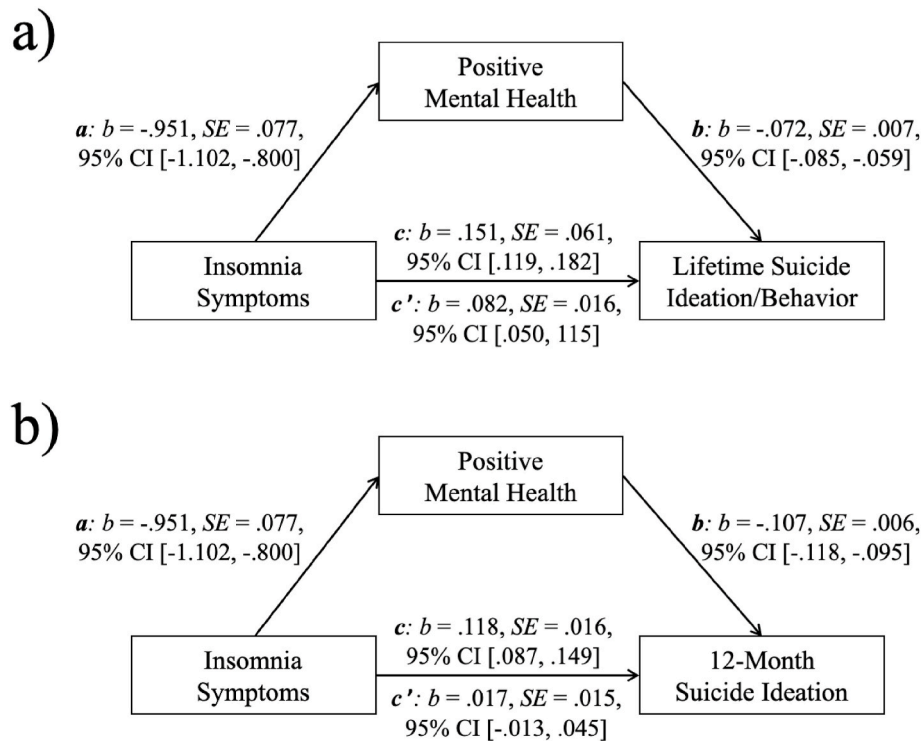


Fig. 1. Indirect effect model with insomnia symptoms as predictor, positive mental health as mediator, and a) lifetime suicide ideation/behavior or b) 12-month suicide ideation as outcome.

Notes. c = total effect, c' = direct effect; b = standardized regression coefficient, SE = standard error, CI = confidence interval.

loving-kindness meditation training could be introduced to the intervention group only. After the training, the levels of PMH, positive and negative emotions, as well as suicide-related outcomes of the intervention group could be compared to those of the waiting control group. Additionally, the levels before and after the training should be compared. If successful, the training could be introduced to the waiting control group at a later stage.

It must be emphasized, however, that the relationship between insomnia symptoms and suicide ideation/behavior, although statistically significant, was weak in magnitude in the current study – as it was in previous studies (Harris et al., 2020). The importance of sleep problems as a risk factor for suicidality should therefore not be over-emphasized. However, it is important to note that the available literature suggests differentiating between chronic sleep problems and acute changes in sleep quality and quantity. The latter one can occur as a component of acute configurations of suicidality (e.g., suicide crisis syndrome, acute suicidal affective disturbance) and, therefore, can serve as a warning sign for it (Galynker, 2017; Rogers et al., 2017).

It is always necessary to consider various factors and their interaction within suicide risk exploration. Sleep problems as well as facets of PMH should be considered as one part of such an exploration. However, insomnia symptoms still constitute an important focus in the treatment of suicidal patients (Bryan and Rudd, 2018), as does fostering PMH (including self-acceptance and self-efficacy) and might represent a viable treatment goal in the management of suicidal patients.

Several limitations of the present study should be noted. First, insomnia symptoms were assessed only in self-report. Studies measuring sleep objectively are suggested as an important area of future investigation. Second, only single insomnia symptoms and no other types of sleep problems (e.g., nightmares, sleep apnoea, restless leg syndrome) were measured. Future studies should conceptualize and assess sleep problems more broadly. Third, the participation in the present study was voluntary. It cannot be excluded that the level of PMH influenced the individual decision for participation. For example, it might be that higher levels of PMH made a participation more likely, while lower levels reduced the participation willingness. Fourth, the rather young and mostly female composition of the current sample limits the generalizability of the present findings to other populations. To tackle this limitation at least partly, age and gender were controlled for in the indirect effect models. However, future research should replicate the present findings in a general population representative sample. Fifth, the current study used a cross-sectional study design. Accordingly, it can only be said that insomnia symptoms, just like PMH are correlates of suicide ideation/behavior. It cannot be said, however, that they are risk or protective factors. Moreover, the association between insomnia symptoms and suicide ideation/behavior may be overestimated in cross-sectional studies compared to longitudinal studies (Liu et al., 2020). Also, the cross-sectional study design does not allow to exclude that insomnia symptoms during the past 12 months (as assessed in the present study) might appear posterior to the lifetime suicide ideation/behavior). Furthermore, due to the cross-sectional study design, the directionality of the investigated models – that is based on theoretical considerations and empirical evidence by available literature on the protective effect of PMH (see for example Brailovskaia et al., 2022b) – remains hypothetical. Alternative possible configurations of the included variables could only be ruled out thorough a longitudinal study design. At the same time, the protective effect of PMH has already been shown in various longitudinal studies (e.g., Brailovskaia et al., 2023; Teismann et al., 2018b); it therefore seems appropriate to re-examine the associations found here in a prospective study design by future research.

To conclude, the present study demonstrated the mitigating effect of PMH on the association between insomnia symptoms and suicide ideation/behavior. Furthermore, it suggests that a therapeutic intervention that targets insomnia symptoms and fosters PMH might be useful in the prevention of suicidal ideation/behavior.

CRediT authorship contribution statement

Julia Brailovskaia: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Tobias Teismann:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Conceptualization. **Jürgen Margraf:** Project administration, Conceptualization, Resources, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this article.

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