

Research paper

Examining components of emotion regulation in relation to sleep problems and suicide risk

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ABSTRACT

Background: Sleep has emerged as an important factor in elevated risk for suicide and suicidal behaviors; however, the mechanisms accounting for this relationship are poorly understood. Emotion regulation is a well-established correlate of self-injurious behaviors; however, the broad construct has recently been shown to provide limited predictive utility. More nuanced investigations into the processes involved in emotion regulation may address this gap. This study sought to examine the mediating role of emotion regulation between sleep disturbances and suicide risk, as well as to evaluate a moderated mediation model in which down- and up-regulation of emotions would moderate this mediation.

Methods: Participants were 972 adults recruited from a crowdsourcing website (Amazon's Mechanical Turk) who completed self-report questionnaires regarding nightmares, suicide risk, and emotion regulation.

Results: Emotion regulation mediated the direct effect of nightmares on suicide risk and suicide attempts. Downregulation of negative affect moderated the mediation of nightmares on suicide risk more clearly than upregulation of positive affect, and neither component of emotion regulation exhibited moderated mediation in the suicide attempt model.

Limitations: Generalizability of our findings from an online community sample will need to be established with replication in other samples. Additionally, we used cross-sectional measures in our mediation models.

Conclusions: Downregulation of negative emotions may be particularly salient in relation to the severity of suicide risk and, as a result, relative deficits in this area should be considered when making risk determinations.

Introduction

Suicide is a major public health problem (Centers for Disease Control and Prevention, 2015). Unfortunately, despite 120 years having passed since Durkheim's treatise on suicide (Durkheim, 1897/1951), and at least 60 years of empirical scholarship in the area, research has yet to yield compelling and consistent pathways to predict who will end up taking their own life (Franklin et al., 2017; Glenn and Nock, 2014). One factor that has begun receiving increased empirical attention in recent years because of its impact on subsequent suicide risk is sleep. Namely, associations between suicide and sleep disturbances ranging from poor sleep quality (e.g., Bernert et al., 2014; Kodaka et al., 2014; Winsler et al., 2015) to insomnia (e.g., Kodaka et al., 2014; Nadorff et al., 2013a) to nightmares (e.g., Nadorff et al., 2013b; Nadorff et al., 2014) have been repeatedly demonstrated.

Despite the well-replicated finding that sleep disturbances are

associated with increased suicide risk, the relationship between these variables is still poorly understood. One potential candidate variable linking suicidal risk with sleep is emotion regulation. It has long been thought that suicidal behavior is the result of maladaptive attempts to cope with negative emotions (Linehan, 1993), and the relation between emotion regulation difficulties and suicidal behavior is well-documented (Neece et al., 2013; Rajappa et al., 2012). Related research suggests that emotion regulation difficulties may also be crucial in explaining the link between nightmares and non-suicidal self-injury (Ennis et al., 2017). Notably, borderline personality disorder—which is characterized by pervasive emotion regulation difficulties (Carpenter and Trull, 2013) and elevated rates of non-suicidal self-injury (e.g., Turner et al., 2015)—has one of the highest suicide mortality rates of any psychological disorder (Chesney et al., 2014). Thus, one approach to understanding suicide risk involves leveraging the overlap of symptoms of borderline personality disorder and emotion regulation

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difficulties. However, it is important to note that emotion regulation difficulties have also been linked to a range of psychological symptoms, including attention-deficit hyperactivity (e.g., Van Eck et al., 2015), depressive (e.g., Jiao et al., 2010), anxiety (e.g., Eck et al., 2017) and eating disorder symptoms (e.g., Haynos et al., 2015). Across varied clinical populations, emotion regulation difficulties have been shown to correlate with increased suicide risk and/or engagement in self-injurious behaviors (e.g., Dixon-Gordon et al., 2014; Ghorbani et al., 2017). This pattern suggests the transdiagnostic role of emotion regulation, underscoring its potential to explain the relation between sleep and suicide.

Recent research suggests that emotion regulation abilities may be impacted by sleep disturbances (Mauss et al., 2013; Sandru and Voinescu, 2014) across the lifespan (Baum et al., 2014; Markarian et al., 2013; Palmer et al., 2018). Specifically, poor sleep quality (Mauss et al., 2013; Sandru and Voinescu, 2014) and insomnia (Palagini et al., 2017) have demonstrated negative effects on emotion regulation capabilities. A recent review also proposed that nightmares may result from emotion regulation deficits (Levin and Nielsen, 2009); although empirical evidence is limited, theory proposes that nightmares may be linked with emotion regulation alongside other types of sleep disturbance. Additional research examining this hypothesis (i.e., that nightmares and emotion regulation are linked) is needed.

Although research has reliably linked sleep disturbances, emotion regulation, and suicide, what is less clear is which emotion regulation processes are most salient. Emotion regulation can be delineated into two relatively independent constructs: efficiency in (1) upregulating positive emotions and (2) downregulating negative emotions (Quoidbach et al., 2015). Capabilities in each domain are only modestly correlated, suggesting that individuals can be proficient in one type of regulation, while deficient in the other (Nelis et al., 2011). Thus, it is possible that one of these emotion regulation capabilities can uniquely explain the relation between sleep disturbance and suicide risk.

Baum et al. (2014) found that experimentally restricting the amount of sleep adolescents obtained for five consecutive days significantly impacted their self- and parent-reported ability to regulate their *negative emotions*. This research suggests that one possible explanation for the relation between sleep disturbances and suicide risk is the increased negative emotion regulation difficulties resulting from poor sleep quality.

Recently, Pilcher et al. (2015) examined the impact of partial and total sleep deprivation on emotional processes by measuring valence and arousal in response to positive and negative images. They found that following sleep deprivation, valence and arousal ratings for both positive and negative images decreased. Furthermore, the effect of sleep deprivation on these ratings was more pronounced for positive images than for negative ones. Thus, evidence also suggests that alteration in the processing and regulation of *positive* information is a candidate pathway linking sleep and suicide, as well.

A well-validated construct that disambiguates the tendency to upregulate positive affect from the tendency to downregulate negative affect is action orientation (Kuhl, 1981, 1994, 2008). Action orientation, which has been studied extensively in personality and clinical science, is a regulatory tendency that allows for more efficient functioning in the face of stressful situations. The two main components involve efficiency of (a) upregulating positive and (b) downregulating negative affect in the face of stress to complete goals.

To further illustrate these two components, consider an individual who finds him or herself experiencing stress related to a memory of a negative life event while attempting to complete a task that requires a high level of effort (e.g., Bryant et al., 2017). That person may need to lower (i.e., downregulate) the negative affect he is experiencing (e.g., by reminding himself that this memory is no longer relevant to his daily life) to be able to give maximum effort to complete the task at hand. Likewise, he may need to increase (i.e., upregulate) the positive affect that he is experiencing (e.g., by imagining the feeling of

accomplishment that he will experience when he has finished his work successfully) to be able to give maximum effort to complete the task at hand. These two action oriented approaches are theorized as relatively independent personality constructs and have empirically produced discriminant patterns of findings (Kuhl and Koole, 2004). For example, in a recent study of adults with borderline personality disorder (Blasczyk-Schiep et al., 2016), downregulation of negative emotions was associated with an increased tendency for self-injurious behaviors, but upregulation of positive emotions was not.

Despite the large literature examining action orientation and other personality and clinical factors, there is as yet limited research examining action orientation in relation to sleep and suicide. Thus, given the prospective differences in positive and negative affective regulatory patterns associated with sleep, and the established association of sleep with suicide, we assessed affect regulation via separable components of action orientation in the present study to provide a specific assessment of which regulatory components help link sleep and suicide.

The purpose of the present study was to assess the extent to which sleep disturbances are related to subsequent suicide risk, and to examine the potential mediating and moderating role of emotion regulation on this relation. Specifically, we were interested in the extent to which downregulation of negative emotions and upregulation of positive emotions were capable of explaining the relation between sleep disturbance (specifically, nightmares) and suicide risk. We hypothesized that borderline symptoms (generally characterized as symptoms associated with emotion regulation deficits) would mediate the relation between nightmares and suicidal risk. Furthermore, we hypothesized a moderated mediation model in which down- and up-regulation of emotions would moderate the mediation. We wished to assess both downregulating negative emotion and upregulating positive emotion to assess if either, both, or neither of these specific aspects of emotion regulation provide further explanatory value than general emotional regulation alone.

2. Methods

2.1. Participants

Participants were recruited through Amazon.com's Mechanical Turk (mTurk), a crowdsourcing software that has been used as a recruiting tool for research studies. The current study was approved through the Institutional Review Board (IRB) of a large Southern University and was conducted using Qualtrics online survey software. Participants were provided a link to the Qualtrics survey site on mTurk that directed them to the IRB-approved study consent form. The consent form informed participants that participation was voluntary and their responses were kept confidential. By clicking "agree," participants provided consent to take part in the study. Research instruments were completed in a randomized order to avoid any order effects or response bias and participants received a small payment (i.e., \$0.25) for completing the study.

A total of 1062 adults from the United States participated in the current study. Missing data on the majority of administered measures were observed for 90 of the 1062 cases. Missing values for these cases were computed via an expectation-maximization algorithm (Enders, 2010) in SPSS. Participant age ranged from 18 to 73 years ($M = 34.57$ years, $SD = 12.05$). The sample was comprised of predominantly White women (72.6% White; 59.7% female). Most were single (36.9%) or married (30.3%) and lived in a small (i.e., 20,000–100,000 residents; 30.3%) or large (i.e., more than 100,000 residents; 29.9%) city. About 47% of participants obtained a post-secondary degree and about 48% were employed for wages; with 43.4% making between \$25,000 and \$75,000 annually.

2.2. Materials

Participants completed demographic questions that queried about

age, gender, race/ethnic background, marital status, current residence (city/state, hometown), residence location type (i.e., rural, small town, small city, large city), highest education level, occupation status, annual income, religious affiliation and frequency of attendance, and questions related to military service.

The *Disturbing Dreams and Nightmare Severity Index* (DDNSI; Krakow et al., 2002) is a self-report measure of nightmare severity and frequency. Severity and frequency, specifically, are assessed via Likert-type scales ranging from 0 (*no problem*) to 6 (*extremely severe problem*). Frequency of night awakenings due to nightmares is assessed on a Likert-type scale ranging from 0 (*never/rarely*) to 4 (*always*). Participants are also asked to indicate the number of nights per week they experience nightmares (0–7 nights), including the total number of nightmares per week (0–14 nightmares). A total score is calculated by summing participant scores from all the above (i.e., severity and frequency of nightmares, frequency of night awakenings, number of nightmares per week, and number of nights with nightmares per week). Scores can range from 0 to 37, with a score greater than 10 indicative of a possible nightmare disorder (Krakow et al., 2002). The DDNSI has shown acceptable reliability ($\alpha = 0.93$) in prior studies (Nadorff et al., 2013b) and a similar internal consistency value was calculated for the current sample (see Table 1).

The *Suicide Behavior Questionnaire – Revised* (SBQ-R; Osman et al., 2001) is a self-report, four-item measure that assesses for lifetime suicide ideation and behavior, frequency of thoughts about attempting suicide over the past 12 months, communication of suicidal intent, and perceived likelihood of attempting suicide in the future. The four items of the SBQ-R are summed to create a total score for suicide risk ranging from 3 to 18. Given its inclusion of items related to past behavior and future perceived likelihood, the SBQ-R total score is commonly used as a measure of suicide risk. Osman et al. (2001) report a cutoff score of 7 for the general population and a score of 8 for psychiatric inpatients that indicate clinically significant levels of risk for suicide-related behavior. The SBQ-R has demonstrated adequate internal consistency in samples of student veterans ($\alpha = 0.84$; Rudd et al., 2011) and in clinical ($\alpha = 0.88$) and nonclinical adult samples ($\alpha = 0.87$) (Osman et al., 2001). A similar internal consistency value was calculated for the current sample (see Table 1). Suicide attempt history was also assessed via the SBQ-R. Participants who reported a score of 5 or 6 on the first item of the SBQ-R were coded as having a past suicide attempt (coded as 0 = no past attempts and 1 = past suicide attempt). Using this method, 144 participants reported a past suicide attempt and 918 denied ever attempting suicide. The SBQ-R total score (suicide risk; i.e., including past behavior and future perceptions) and the SBQ-R item 1 response

(suicide attempt history; i.e., an indicator of elevated risk based specifically on past behavior) were each used as dependent variables.

The *Borderline Symptom List-23* (BSL-23; Bohus et al., 2009) is a shortened, 23-item version of the 95-item Borderline Symptom List. The BSL-23 assesses for symptoms of borderline personality disorder (BPD) over the past week using a Likert-type scale ranging from 0 (*not at all*) to 4 (*very strong*). The original BSL items were developed based on BPD criteria from the fourth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV; American Psychiatric Association, 1994), views from borderline personality disorder patients and experts (Bohus et al., 2001), and the revised Diagnostic Interview for BPD (Zanarini et al., 1989). The BSL-23 has shown acceptable reliability ($\alpha = 0.97$) in prior studies (Bohus et al., 2009) and from the current sample ($\alpha = 0.97$). For the current study, we removed items five (*I thought of hurting myself*), seven (*I didn't believe in my right to live*), and eighteen (*The idea of death had a certain fascination for me*) due to the items potentially overlapping with suicide risk and biasing results. With these items removed, the internal consistency value calculated from the current sample was similar to prior research (see Table 1).

The *Action Control Scale* (ACS; Kuhl, 1994) is a self-report, 36-item measure of self-regulatory capabilities that can distinguish between action and state orientations. The ACS consists of three subscales: Failure-related action orientation vs. preoccupation (AOF), prospective and decision-related action orientation vs. hesitation (AOD), and performance-related action orientation vs. volatility (AOP). Items on the ACS are dichotomous with each response pertaining either to an action or state orientation. Total scores are obtained for the subscales by summing their respective action-oriented responses, with scores ranging from 0 to 12 for each subscale. For the current study, only the AOF and AOD subscales were included in analyses. The AOF subscale has been shown to assess downregulation of negative emotion, whereas the AOD subscale assesses upregulation of positive emotions, in the face of potential stress (Kuhl, 1981, 1994, 2008; Kuhl and Koole, 2004). Higher scores suggest greater action orientation for that specific subscale (i.e., greater downregulation or upregulation) while lower scores suggest greater state orientation (i.e., lower downregulation or upregulation; Bauman et al., 2007; Kuhl, 1981). Prior studies have shown adequate reliability for both the AOF ($\alpha = 0.85$) and AOD ($\alpha = 0.83$) subscales (Bauman et al., 2007) and similar internal consistency values were calculated for the current sample (see Table 1).

2.3. Data analysis

Descriptive statistics, zero-order correlations, and reliability coefficients for the research instruments can be found in Table 1. As can be observed in Table 1, all the variables included in our study were significantly correlated. To examine whether downregulation of negative emotions and/or upregulation of positive emotions (i.e., AOF and AOD) can inform the relations between nightmares, general emotion regulation, and suicide risk and prior suicide attempts, we analyzed four moderated mediation models in IBM SPSS Statistics (Version 24) using Model 8 from the PROCESS macro (Hayes, 2013). The initial two models used either AOF or AOD as the moderating variable, the total score from the SBQ-R as the outcome variable, the BSL-23 total score (with suicide ideation items excluded) as the mediating variable, and nightmares as the independent variable (see Fig. 1a and b). For the final two models, the outcome variable was changed from suicide risk (SBQ-R total score) to suicide attempt history (see Fig. 1c and d). Suicide attempt history was coded dichotomously, with participants either endorsing a previous attempt (yes = 1) or denying a history of nonfatal suicide attempts (no = 0).

3. Results

Model 1. The overall regression model was significant (see Table 2 and Fig. 2a). There was a significant indirect effect of nightmares on

Table 1

Means, standard deviations, correlations and reliability among variables.

	1	2	3	4	5	6
1 SBQ-R	–	0.57**	0.31**	0.59**	–0.31**	–0.29**
2 SA	–	–	0.23**	0.26**	–0.10**	–0.07*
3 DDN	–	–	–	0.40**	–0.22**	–0.17**
4 BSL	–	–	–	–	–0.44**	–0.46**
5 AOF	–	–	–	–	–	0.63**
6 AOD	–	–	–	–	–	–
Mean	8.52	0.14	10.81	26.75	4.41	4.74
standard deviation	4.38	0.34	5.31	19.24	3.19	3.45
Reliability (Cronbach's alpha)	0.84	–	0.89	0.96	0.80	0.84

Note.

** $p < .01$.

* $p < .05$. SBQ-R = Suicidal Behavior Questionnaire – Revised; SA = Suicide attempt history; DDN = Disturbing Dreams and Nightmares Severity Index; BSL = Borderline Symptom List-23 (items 5, 7, and 18 excluded); AOF = Failure-related action orientation vs. preoccupation (i.e., downregulation of negative emotions); AOD = Prospective and decision-related action orientation vs. hesitation (i.e., upregulation of positive emotions)

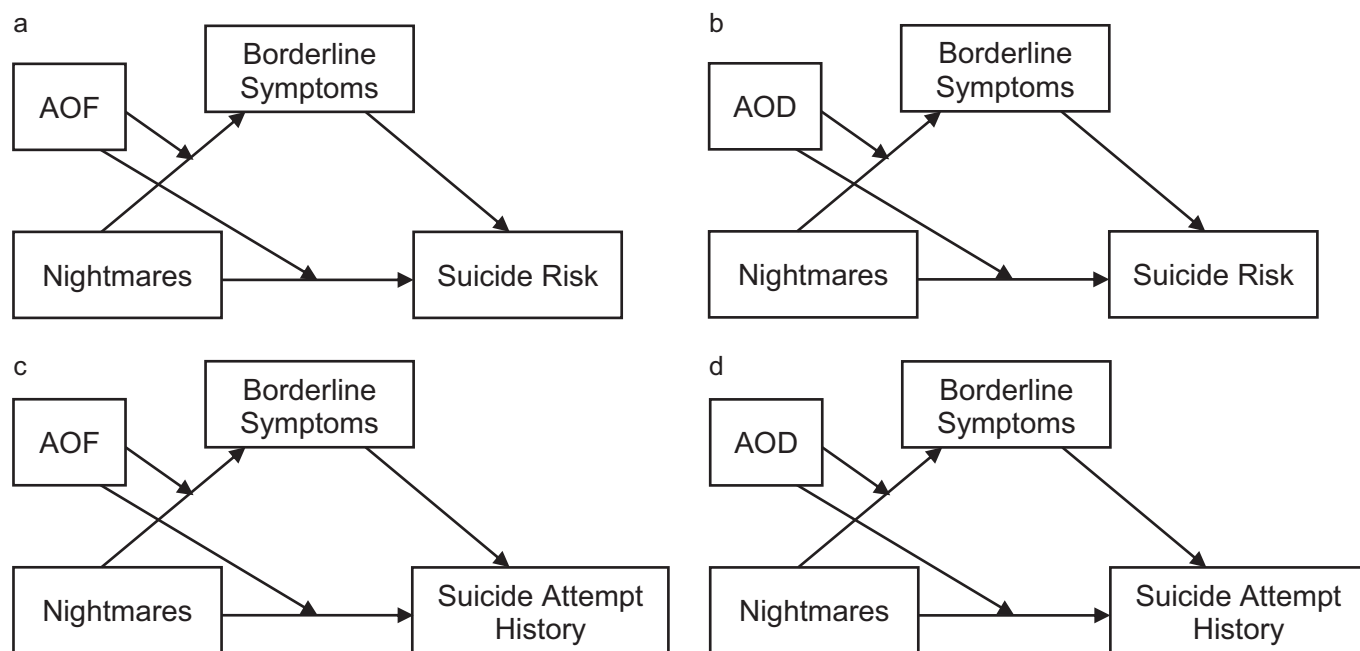


Fig. 1. Conceptual diagrams of models 1–4. (a) Conceptual diagram of model 1. (b) Conceptual diagram of model 2. (c) Conceptual diagram of model 3. (d) Conceptual diagram of model 4.

suicide risk through severity of borderline symptoms. The effect of nightmares on severity of borderline symptoms was dependent on AOF and the conditional indirect effects at low, moderate, and high values of AOF all differed significantly from zero; with the greatest effect observed among those reporting a greater state orientation of pre-occupation (i.e., low AOF value, poor downregulation of negative emotions). The direct effect of nightmares on suicide risk was significant, and downregulation of negative emotions did not moderate this relationship (as evidenced by a nonsignificant c'_3 path). Thus, it appears that nightmares had different effects on borderline symptom severity depending on whether one engaged in downregulation of negative emotions. However, the influence of nightmares on suicide risk was not conditional on downregulation of negative emotions and depended more on severity of borderline symptoms.

Model 2. The overall regression model was significant (see Table 3 and Fig. 2b). There was a significant indirect effect of nightmares on suicide risk through severity of borderline symptoms. A greater state orientation of hesitation (i.e., low AOD value, poor upregulation of positive emotions) was associated with more severe borderline

symptoms. The direct effect of nightmares on suicide risk was significant and AOD did not moderate this relationship (as evidenced by a nonsignificant c'_3 path). Thus, it appears that the influence of nightmares on suicide risk was not conditional on upregulation of positive emotions and depended more on severity of borderline symptoms.

Model 3. The overall regression model was significant (see Table 4 and Fig. 3a). There was a significant indirect effect of nightmares on suicide attempt history through severity of borderline symptoms. Similar to model 1, the effect of nightmares on severity of borderline symptoms was dependent on AOF and the conditional indirect effects at low, moderate, and high values of AOF all differed significantly from zero. However, the conditional indirect effect values for low, moderate, and high displayed a smaller range compared to model 1 (0.03 to 0.04). The direct effect of nightmares on suicide attempt history was significant, but downregulation of negative emotions did not moderate this relationship (as evidenced by a nonsignificant c'_3 path). Thus, similar to model 1, nightmares appeared to have different effects on borderline symptoms severity depending on whether one engaged in downregulation of negative emotions. However, the influence of

Table 2

Regression results for testing moderation of downregulation of negative emotions on the relations between emotion regulation, nightmares, and suicide risk.

		M (BSL)			Y (SBQ-R)		
		Coeff.	SE	p	Coeff.	SE	p
X (DDN)	a_1	1.40	0.15	< 0.001	c'_1	0.12	0.03
M (BSL)		–	–	–	b	0.12	0.01
W (AOF)	a_2	–1.56	0.35	< 0.001	c'_2	0.03	0.08
X × W	a_3	–0.06	0.03	.045	c'_3	–0.01	0.01
Constant	i_1	21.23	1.95	< 0.001	i_2	4.44	0.45
$R^2 = 0.29$					$R^2 = 0.36$		
$F(3, 1058) = 144.25, p < .001$					$F(4, 1057) = 146.48, p < .001$		
Indirect effect					Direct effect		
W	Effect	95% Bias-corrected bootstrap CI		Effect	SE	p	
1.22	0.16	0.13–0.20		0.10	0.03	< 0.001	
4.41	0.13	0.11–0.17		0.07	0.02	.004	
7.60	0.11	0.07–0.15		0.03	0.03	.374	

Note. M = mediating variable; BSL = Borderline Symptom List-23 (items 5, 7, and 18 excluded); Y = dependent variable; SBQ-R = Suicidal Behaviors Questionnaire – Revised; DDN = Disturbing Dreams and Nightmare Severity Index; AOF = Failure-related action orientation vs. preoccupation (i.e., downregulation of negative emotions)

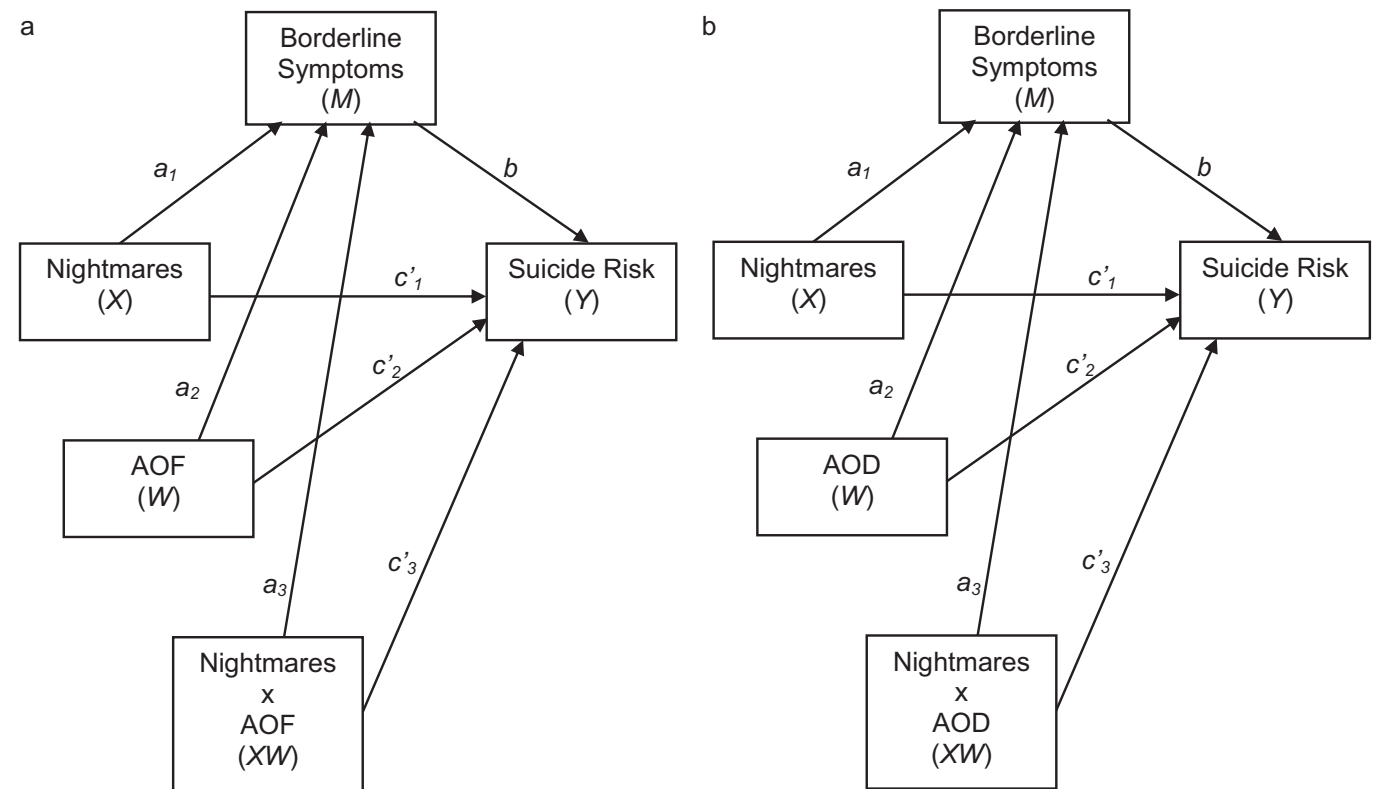


Fig. 2. Statistical diagrams of models 1–2. (a) Statistical diagram of the moderation of downregulation of negative emotions on the relations between emotion regulation, nightmares, and suicide risk. (b) Statistical diagram of the moderation of upregulation of positive emotions on the relations between emotion regulation, nightmares, and suicide risk.

nightmares on suicide risk was not conditional on downregulation of negative emotions and depended more on the severity of borderline symptoms.

Model 4. The overall regression model was significant (see Table 5 and Fig. 3b). There was a significant direct effect of nightmares on suicide attempt history and a significant indirect effect of nightmares on suicide attempt history through severity of borderline symptoms. Poor upregulation of positive emotion was associated with more severe borderline symptoms. Like model 2, upregulation of positive emotions did not moderate the direct relationship between nightmares and suicide attempt history (as evidenced by a nonsignificant c'_3 path). Similar to model 2, it appears that the influence of nightmares on suicide attempt history was not conditional on upregulation of positive emotions

and depended more on severity of borderline symptoms.

4. Discussion

Emerging research has highlighted the important role of sleep disturbances and subsequent suicide risk (Nadorff et al., 2014). The factors mediating this relation, however, are poorly understood. Given that prior research has consistently demonstrated a relation between emotion regulation capabilities and subsequent suicide risk (Rajappa et al., 2012) and sleep disturbances appear to impact emotion regulation (Mauss et al., 2013), emotion regulation may provide an explanation for this link. However, even a relatively well-studied variable like emotion regulation is subject to the limitations in predictive power,

Table 3
Regression results for testing moderation of upregulation of positive emotions on the relations between emotion regulation, nightmares, and suicide risk.

		M (BSL)			Y (SBQ-R)		
		Coeff.	SE	p	Coeff.	SE	p
X (DDN)	a_1	1.38	0.15	< 0.001	c'_1	0.13	< 0.001
M (BSL)		–	–	–	b	0.12	< 0.001
W (AOD)	a_2	–1.85	0.31	< 0.001	c'_2	0.09	.188
X × W	a_3	–0.04	0.03	.131	c'_3	–0.01	.054
Constant	i_1	22.48	1.90	< 0.001	i_2	3.99	< 0.001
		$R^2 = 0.32$			$R^2 = 0.36$		
		$F(3, 1058) = 168.14, p < .001$			$F(4, 1057) = 145.38, p < .001$		
Indirect effect					Direct effect		
W	Effect	95% Bias-corrected bootstrap CI			Effect	SE	p
1.29	0.16	0.13–0.21			0.11	0.03	< 0.001
4.74	0.15	0.12–0.18			0.07	0.02	.001
8.19	0.13	0.09–0.17			0.03	0.03	.302

Note. M = mediating variable; BSL = Borderline Symptom List-23 (items 5, 7, and 18 excluded); Y = dependent variable; SBQ-R = Suicidal Behaviors Questionnaire – Revised; DDN = Disturbing Dreams and Nightmare Severity Index; AOD = Prospective and decision-related action orientation vs. hesitation (i.e., upregulation of positive emotions)

Table 4
Regression results for testing moderation of downregulation of negative emotions on the relations between emotion regulation, nightmares, and suicide attempt history.

		M (BSL)			Y (SA)		
		Coeff.	SE	p	Coeff.	SE	p
X (DDN)	a_1	1.40	0.15	< 0.001	c'_1	0.10	< 0.001
M (BSL)		–	–	–	b	0.03	< 0.001
W (AOF)	a_2	–1.56	0.35	< 0.001	c'_2	0.12	.099
X × W	a_3	–0.06	0.03	.045	c'_3	–0.01	.087
Constant	i_1	21.23	1.95	< 0.001	i_2	–4.05	< 0.001
$R^2 = 0.29$					Nagelkerke $R^2 = 0.14$		
$F(3, 1058) = 144.25, p < .001$					$p < .001$		
Indirect effect					Direct effect		
W	Effect	95% Bias-corrected bootstrap CI			Effect	SE	p
1.22	0.04	0.03–0.06			0.09	0.02	< 0.001
4.41	0.03	0.02–0.05			0.06	0.02	< 0.001
7.60	0.03	0.02–0.04			0.03	0.03	.295

Note. M = mediating variable; BSL = Borderline Symptom List-23 (items 5, 7, and 18 excluded); Y = dependent variable; SA = Suicide attempt history; DDN = Disturbing Dreams and Nightmare Severity Index; AOF = Failure-related action orientation vs. preoccupation (i.e., downregulation of negative emotions)

which were highlighted by a meta-analytic review of the risk and protective factor literature (Franklin et al., 2017) – namely, that such variables do not provide long-term predictive capability above the level of chance for an eventual death by suicide. Thus, breaking complex constructs like emotion regulation into component parts may provide a more compelling understanding of their relation with suicide. This study aimed to evaluate the extent to which sleep disturbance (i.e., nightmares) is related to suicide risk by considering the mediating and moderating role of emotion regulation. Specifically, we investigated the effect of upregulation of positive emotions and downregulation of negative emotions on this relation beyond general emotion regulation. Given prior research (e.g., Baum et al., 2014; Pilcher et al., 2015), we

hypothesized that emotion regulation would mediate the relation between nightmares and suicide risk and that up- and down-regulation of emotions would moderate this mediated relationship.

We found that the indirect effect of emotion regulation significantly reduced the direct effect of nightmares on suicide risk, and that this effect was moderated by downregulation of negative emotions more clearly than by upregulation of positive emotions when comparing models 1 and 2. This is consistent with our hypotheses based on prior research in adolescents in which restricted sleep led to poor down-regulation ability (Baum et al., 2014). Moreover, we found that suicide attempt history was directly predicted by nightmares, and that emotion regulation, as measured by borderline symptoms, was a mechanism

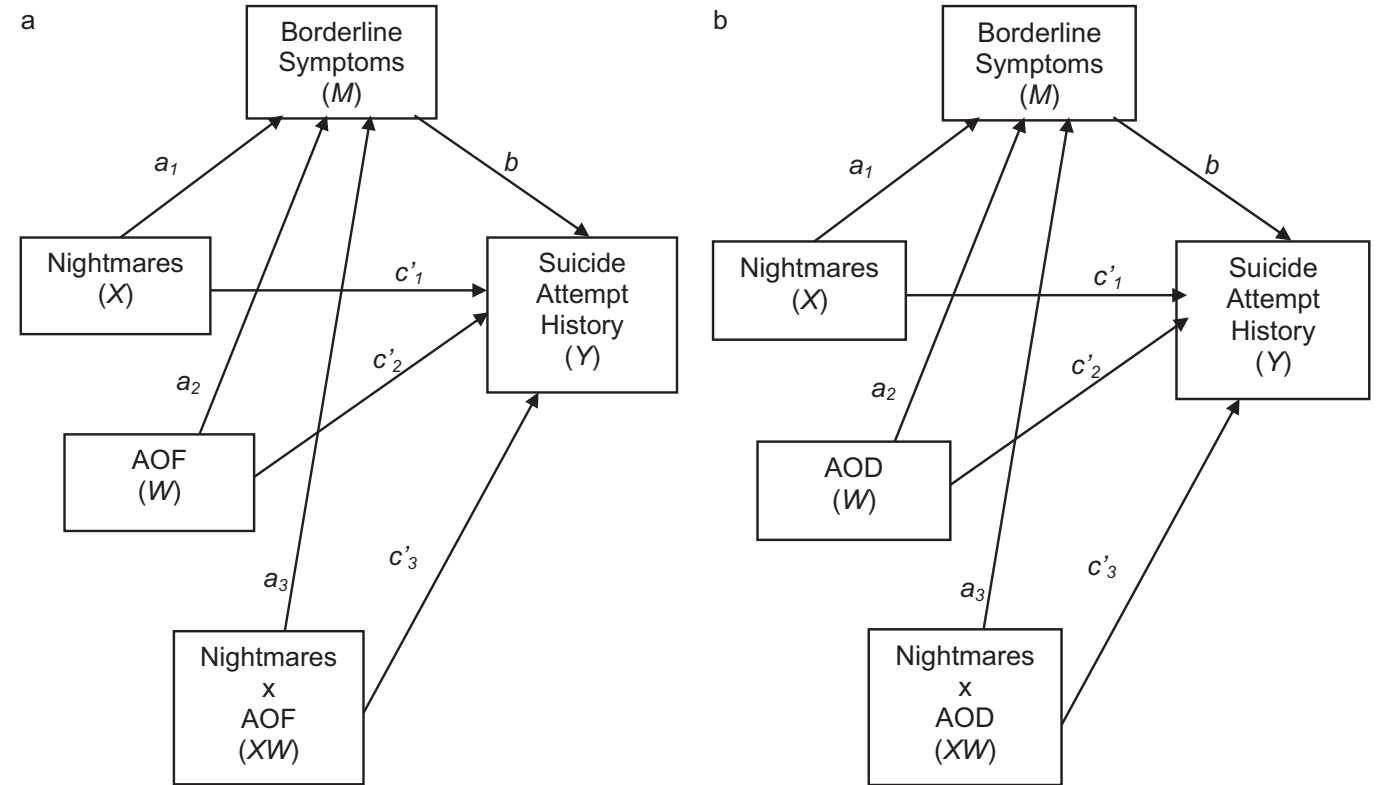


Fig. 3. Statistical diagrams of models 3–4. (a) Statistical diagram of the moderation of downregulation of negative emotions on the relations between emotion regulation, nightmares, and suicide attempt history. (b) Statistical diagram of the moderation of upregulation of positive emotions on the relations between emotion regulation, nightmares, and suicide attempt history.

Table 5

Regression results for testing moderation of upregulation of positive emotions on the relations between emotion regulation, nightmares, and suicide attempt history.

		M (BSL)			Y (SA)		
		Coeff.	SE	p	Coeff.	SE	p
X (DDN)	a_1	1.38	0.15	< 0.001	c'_1	0.07	0.003
M (BSL)		–	–	–	b	0.03	< 0.001
W (AOD)	a_2	–1.85	0.31	< 0.001	c'_2	0.07	.265
$X \times W$	a_3	–0.04	0.03	.131	c'_3	–0.002	.681
Constant	i_1	22.48	1.90	< 0.001	i_2	–4.00	< 0.001
$R^2 = 0.32$					Nagelkerke $R^2 = 0.14$		
$F(3, 1058) = 168.14, p < .001$					$p < .001$		
Indirect effect					Direct effect		
W	Effect	95% Bias-corrected bootstrap CI		Effect	SE	p	
1.29	0.04	0.03–0.06		0.07	0.02	< 0.001	
4.74	0.04	0.02–0.06		0.07	0.02	< 0.001	
8.19	0.04	0.02–0.05		0.06	0.02	.014	

Note. M = mediating variable; BSL = Borderline Symptom List-23 (items 5, 7, and 18 excluded); Y = dependent variable; SA = Suicide attempt history; DDN = Disturbing Dreams and Nightmare Severity Index; AOD = Prospective and decision-related action orientation vs. hesitation (i.e., upregulation of positive emotions)

through which this relation was indirectly explained in models 3 and 4. We did not find compelling evidence of moderated mediation when considering specific aspects of emotion regulation in relation to previous suicide attempts, however. This result contrasts our hypotheses as well as recent research by Pilcher et al. (2015) who found sleep deprivation negatively impacted regulation of positive information.

In summary, our results suggest that downregulation of negative emotions, relative to upregulation of positive ones, may play a more important role in moderating the mediating role of general emotion regulation on the relation between nightmares and suicide risk. This suggests important implications for treatment focused on sleep difficulties and suicide risk. Specifically, an emphasis on increasing skills to reduce negative emotions may be more effective at mitigating suicide risk than attempts to increase positive emotions. That is, difficulty downregulating negative emotions may interfere more with efforts to improve sleep or manage other variables related to increased suicide risk (e.g., symptoms associated with a range of psychological disorders including borderline personality disorder, post-traumatic stress disorder, depression) and, therefore, targeting this transdiagnostic mechanism may be more effective at reducing future risk.

Several limitations should be considered when interpreting these results. First, data were collected online using self-report measures via Amazon's Mechanical Turk (mTurk). Although mTurk samples have been shown to be more diverse than college student samples (Berinsky et al., 2012), they also tend to be younger, more educated, more liberal, and they include a higher proportion of White and Asian American participants than the general U.S. population (Chandler and Shapiro, 2016). Thus, (a) these findings will need to be replicated in more generalizable samples, including clinical populations and those with high levels of emotion regulation deficits, and (b) future studies will benefit from incorporating behavioral measures of negative and positive emotional biases (Winer et al., 2011; Winer and Salem, 2016). Second, any examination of mediation using a cross-sectional sample is atemporal because it does not allow for the investigation of variables over time (Winer et al., 2016). Thus, we are unable to infer causality in the current study, and future longitudinal work examining these variables is needed. Third, we used the Borderline Symptom List-23 (Bohus et al., 2009) as a measure of general emotion regulation deficits. This measure is designed to capture symptoms of borderline personality disorder, a disorder characterized by pervasive emotion regulation deficits; however, the questionnaire may also include constructs beyond emotion regulation that may account for its mediating role between nightmares and suicide risk. Future research should include assessment instruments exclusively focused on emotion regulation. Finally, using suicide attempt history as a dependent variable introduces a

discrepancy in time points given nightmares, borderline symptoms, and emotion regulation reflect participant functioning that may be closer in time than their most recent nonfatal suicide attempt. However, the bias incurred by these different time points is conservative as it is likely to reduce the correlations between these variables. Therefore, this conservative bias lends further confidence to our findings.

Despite these limitations, our results suggest that considering component elements of emotion regulation, rather than general emotion regulation per se, may help explain the relation between sleep disturbances and suicide risk. Specifically, our results highlight the particular importance of difficulties downregulating negative emotional experiences relative to upregulation of positive ones. As such, differential consideration of these separate processes may provide a more nuanced understanding of the factors that contribute to an increased risk for suicide and more accurate information to use in suicide risk assessment.

Conflict of interest

All authors declare that they have no conflicts of interest.

Author disclosure

Drs. Ward-Ciesielski, Winer, Drapeau, and Nadorff each contributed to the conceptualization and preparation of this manuscript. Dr. Nadorff collected the dataset analyzed in this manuscript and Drs. Drapeau and Nadorff analyzed the data presented herein. All authors contributed to and have approved the final manuscript.

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References

- American Psychiatric Association, 1994. Diagnostic and Statistical Manual of Mental Disorders, fourth ed. Washington, DC.
- Baum, K.T., Desai, A., Field, J., Miller, L.E., Rausch, J., Beebe, D.W., 2014. Sleep restriction worsens mood and emotion regulation in adolescents. *J. Child. Psychol. Psych.* 55, 180–190. <https://doi.org/10.1111/jcpp.12125>.
- Baumann, N., Kaschel, R., Kuhl, J., 2007. Affect sensitivity and affect regulation in dealing with positive and negative affect. *J. Res. Pers.* 41, 239–248. <https://doi.org/>

- 10.1016/j.jrp.2006.05.002.
- Berinsky, A.J., Huber, G.A., Lens, G.S., 2012. Evaluating online labor markets for experimental research: Amazon.com's Mechanical Turk. *Polit. Anal.* 20, 351–368.
- Bernert, R.A., Turvey, C.L., Conwell, Y., Joiner, T.E., 2014. Association of poor subjective sleep quality with risk for death by suicide during a 10-year period: a longitudinal, population-based study of late life. *JAMA Psychiat.* 71, 1129–1137. <https://doi.org/10.1001/jamapsychiatry.2014.1126>.
- Blasczyk-Schiep, S., Jaworska-Andryszewska, P., Rabska, E., Lason, A., Niezgoda, E., Fila-Witeka, K., 2016. Emotion regulation, depression and self-harming behaviours in people with borderline personality disorder: the moderating role of action vs. state orientation. *Curr. Issues Personal. Psychol.* 4, 41–49. <https://doi.org/10.5114/cipp.2016.56326>.
- Bohus, M., Kleindienst, N., Limberger, M.F., Stieglitz, R.-D., Domsalla, M., Chapman, A.L., Wolf, M., 2009. The short version of the borderline symptom list (BSL-23): development and initial data on psychometric properties. *Psychopathology* 42, 32–39. <https://doi.org/10.1159/000173701>.
- Bohus, M., Limberger, M.F., Frank, U., Sender, I., Gratwohl, T., Stieglitz, R.-D., 2001. Entwicklung der borderline-symptom-liste. *Psychother. Psych. Med.* 51, 201–211. <https://doi.org/10.1055/s-2001-13281>.
- Bryant, J., Winer, E.S., Salem, T., Nadorff, M.R., 2017. Struggling toward reward: Recent experience of anhedonia interacts with motivation to predict reward pursuit in the face of a stressful manipulation. *PLoS One* 12, e0173439. <https://doi.org/10.1371/journal.pone.0173439>.
- Carpenter, R.W., Trull, T.J., 2013. Components of emotion dysregulation in borderline personality disorder: a review. *Curr. Psychiat. Rep.* 15, 335–342. <https://doi.org/10.1007/s11920-012-0335-2>.
- Centers for Disease Control and Prevention, 2015. Suicide: Facts at a Glance 2015. <https://www.cdc.gov/violenceprevention/pdf/suicide-datasheet-a.pdf> (accessed 01 August 2017).
- Chandler, J., Shapiro, D., 2016. Conducting clinical research using crowdsourced convenience samples. *Annu. Rev. Clin. Psychol.* 12, 53–81.
- Chesney, E., Goodwin, G.M., Fazel, S., 2014. Risks of all-cause and suicide mortality in mental disorders: a meta-review. *World Psychiatry* 13, 153–160. <https://doi.org/10.1002/wps.20128>.
- Dixon-Gordon, K.L., Tull, M.T., Gratz, K.L., 2014. Self-injurious behaviors in posttraumatic stress disorder: an examination of potential moderators. *J. Affect. Disord.* 166, 359–367. <https://doi.org/10.1016/j.jad.2014.05.033>.
- Durkheim, E., 1897. *Suicide: A Study in Sociology*. 1951. The Free Press, New York, NY.
- Eck, K., Warren, P., Flory, K., 2017. A variable-centered and person-centered evaluation of emotion regulation and distress tolerance: links to emotional and behavioral concerns. *J. Youth Adol.* 46, 136–150. <https://doi.org/10.1007/s10964-016-0542-y>.
- Enders, C.K., 2010. *Applied missing data analysis*. Guilford press, New York, NY.
- Ennis, C.R., Short, N.A., Moltisanti, A.J., Smith, C.E., Joiner, T.E., Taylor, J., 2017. Nightmares and nonsuicidal self-injury: the mediating role of emotional dysregulation. *Compr. Psychiatry* 76, 104–112. <https://doi.org/10.1016/j.comppsy.2017.04.003>.
- Franklin, J.C., Ribeiro, J.D., Fox, K.R., Bentley, K.H., Kleiman, E.M., Huang, X., Nock, M.K., 2017. Risk factors for suicidal thoughts and behaviors: A meta-analysis of 50 years of research. *Psychol. Bull.* 143, 187–232. <https://doi.org/10.1037/bul0000084>.
- Ghorbani, F., Khosravani, V., Sharifi Bastan, F., Jamaati Ardakani, R., 2017. The alexithymia, emotion regulation, emotion regulation difficulties, positive and negative affects, and suicidal risk in alcohol-dependent outpatients. *Psychiatry Res.* 252, 223–230. <https://doi.org/10.1016/j.psychres.2017.03.005>.
- Glenn, C.R., Nock, M.K., 2014. Improving the short-term prediction of suicidal behavior. *Amer. J. Prev. Med.* 47, S176–S180.
- Hayes, A.F., 2013. *Introduction to Mediation, Moderation, and Conditional Process Analysis: A Regression-Based Approach*. Guilford Press, New York, NY.
- Haynos, A.F., Roberto, C.A., Attia, E., 2015. Examining the associations between emotion regulation difficulties, anxiety, and eating disorder severity among inpatients with anorexia nervosa. *Compr. Psychiatry* 60, 93–98. <https://doi.org/10.1016/j.comppsy.2015.03.004>.
- Jiao, B., Lu, J., Yang, S., Chen, C., Liu, T., 2010. Structural equation modeling analysis of adolescents' life events, cognitive emotion regulation, depression and suicide ideation. *Chin. J. Clin. Psychol.* 18, 480–482.
- Kodaka, M., Matsumoto, T., Katsumata, Y., Akazawa, M., Tachimori, H., Kawakami, N., Takeshima, T., 2014. Suicide risk among individuals with sleep disturbances in Japan: a case-control psychological autopsy study. *Sleep Med.* 15, 430–435. <https://doi.org/10.1016/j.sleep.2013.11.789>.
- Krakow, B.J., Melendrez, D.C., Johnston, L.G., Clark, J.O., Santana, E.M., Warner, T.D., Lee, S.A., 2002. Sleep dynamic therapy for Cerro Grande Fire evacuees with post-traumatic stress symptoms: a preliminary report. *J. Clin. Psychiatry* 63, 673–684. <https://doi.org/10.4088/JCP.v63n0804>.
- Kuhl, J., 1981. Motivational and functional helplessness: The moderating effect of state versus action orientation. *J. Pers. Soc. Psychol.* 40, 155–170. <https://doi.org/10.1037/0022-3514.40.1.155>.
- Kuhl, J., 1994. Action versus state orientation: psychometric properties of the Action Control Scale (ACS-90). In: Kuhl, J., Beckmann, J. (Eds.), *Volition and Personality: Action versus State Orientation*. Hogrefe, Göttingen, Germany.
- Kuhl, J., 2008. Individual differences in self-regulation. In: Heckhausen, J., Heckhausen, H. (Eds.), *Motivation and Action*, (second ed.). Cambridge University Press, New York, NY, pp. 296–322.
- Kuhl, J., Koole, S.L., 2004. Workings of the will: a functional approach. In: Greenberg, J., Koole, S.L., Pyszczynski, T. (Eds.), *Handbook of Experimental Existential Psychology*. Guilford Press, New York, NY, pp. 411–430.
- Levin, R., Nielsen, T., 2009. Nightmares, bad dreams, and emotion dysregulation: a review and new neurocognitive model of dreaming. *Curr. Dir. Psychol. Sci.* 18, 84–88. <https://doi.org/10.1111/j.1467-8721.2009.01614.x>.
- Linehan, M.M., 1993. *Cognitive-Behavioral Treatment of Borderline Personality Disorder*. Guilford Press, New York, NY.
- Markarian, S.A., Pickett, S.M., Deveson, D.F., Kanona, B.B., 2013. A model of BIS/BAS sensitivity, emotion regulation difficulties, and depression, anxiety, and stress symptoms in relation to sleep quality. *Psychiat. Res.* 210, 281–286. <https://doi.org/10.1016/j.psychres.2013.06.004>.
- Maus, I.B., Troy, A.S., LeBourgeois, M.K., 2013. Poorer sleep quality is associated with lower emotion regulation ability in a laboratory paradigm. *Cognit. Emot.* 27, 567–576. <https://doi.org/10.1080/02699931.2012.727783>.
- Nadorff, M.R., Anestis, M.D., Nazem, S., Harris, H.C., Winer, E.S., 2014. Sleep disorders and the interpersonal-psychological theory of suicide: independent pathways to suicidality? *J. Affect. Disord.* 152–154, 505–512. <https://doi.org/10.1016/j.jad.2013.10.011>.
- Nadorff, M.R., Fiske, A., Sperry, J.A., Petts, R., Gregg, J.J., 2013a. Insomnia symptoms, nightmares, and suicidal ideation in older adults. *J. Gerontol., Ser. B Psychological Sciences and Social Sciences* 68, 145–152. <https://doi.org/10.1093/geronb/gbs061>.
- Nadorff, M.R., Nazem, S., Fiske, A., 2013b. Insomnia symptoms, nightmares and suicide risk: Duration of sleep disturbance matters. *Suicide Life-Threat* 43, 139–149. <https://doi.org/10.1111/sltb.12003>.
- Neece, C.L., Berk, M.S., Combs-Ronto, L.A., 2013. Dialectical behavior therapy and suicidal behavior in adolescence: linking developmental theory and practice. *Prof. Psychol. Res. Pr.* 44, 257–265. <https://doi.org/10.1037/a0033396>.
- Nelis, D., Quoidbach, J., Hansenne, M., Mikolajczak, M., 2011. Measuring individual differences in emotion regulation: the emotion regulation profile-revised (ERP-R). *Psychol. Belg.* 51, 49–91.
- Osman, A., Bagge, C.L., Gutierrez, P.M., Konick, L.C., Kopper, B.A., Barrios, F.X., 2001. The suicidal behaviors questionnaire-revised (sbq-r): validation with clinical and nonclinical samples. *Assessment* 8, 443–454. <https://doi.org/10.1177/107319110100800409>.
- Palagini, L., Moretto, U., Dell'Osso, L., Carney, C., 2017. Sleep-related cognitive processes, arousal, and emotion dysregulation in insomnia disorder: The role of insomnia-specific rumination. *Sleep Med.* 30, 97–104. <https://doi.org/10.1016/j.sleep.2016.11.004>.
- Palmer, C.A., Oosterhoff, B., Bower, J.L., Kaplow, J.B., Alfano, C.A., 2018. Associations among adolescent sleep problems, emotion regulation, and affective disorders: Findings from a nationally representative sample. *J. Psychiat. Res.* 96, 1–8. <https://doi.org/10.1016/j.jpsychires.2017.09.015>.
- Pilcher, J.J., Callan, C., Posey, J.L., 2015. Sleep deprivation affects reactivity to positive but not negative stimuli. *J. Psychosom. Res.* 79, 657–662. <https://doi.org/10.1016/j.jpsychores.2015.05.003>.
- Quoidbach, J., Mikolajczak, M., Gross, J.J., 2015. Positive interventions: an emotion regulation perspective. *Psychol. Bull.* 141, 655–693. <https://doi.org/10.1037/a0038648>.
- Rajappa, K., Gallagher, M., Miranda, R., 2012. Emotion dysregulation and vulnerability to suicidal ideation and attempts. *Cogn. Ther. Res.* 36, 833–839. <https://doi.org/10.1007/s10608-011-9419-2>.
- Rudd, M.D., Goulding, J., Bryan, C.J., 2011. A national survey exploring psychological symptoms and suicide risk. *Prof. Psychol. Res. Pr.* 42, 354–360. <https://doi.org/10.1037/a0025164>.
- Turner, B.J., Dixon-Gordon, K.L., Austin, S.B., Rodriguez, M.A., Rosenthal, Z.M., Chapman, A.L., 2015. Non-suicidal self-injury with and without borderline personality disorder: differences in self-injury and diagnostic comorbidity. *Psychiatry Res.* 230, 28–35. <https://doi.org/10.1016/j.psychres.2015.07.058>.
- Sandru, C., Voinescu, B.I., 2014. The relationship between emotion regulation, dysfunctional beliefs about sleep and sleep quality – an exploratory study. *J. Evid. Based Psychot.* 14, 249–257.
- Van Eck, K., Ballard, E., Hart, S., Newcomer, A., Musci, R., Flory, K., 2015. ADHD and suicidal ideation: the roles of emotion regulation and depressive symptoms among college students. *J. Atten. Disord.* 19, 703–714. <https://doi.org/10.1177/1087054713518238>.
- Winer, E.S., Cervone, D., Bryant, J.C., McKinney, C., Liu, R.T., Nadorff, M.R., 2016. Distinguishing mediational models and analyses in clinical psychology: atemporal associations do not imply causation. *J. Clin. Psychol.* 72, 947–955. <https://doi.org/10.1002/jclp.22298>.
- Winer, E.S., Cervone, D., Newman, L.S., Snodgrass, M., 2011. Subchance perception: anxious, non-defensive individuals identify subliminally-presented positive words at below-chance levels. *Pers. Individ. Differ.* 51, 996–1001. <https://doi.org/10.1016/j.paid.2011.08.010>.
- Winer, E.S., Salem, T., 2016. Reward devaluation: dot-probe meta-analytic evidence of avoidance of positive information in depressed persons. *Psychol. Bull.* 142, 18–78. <https://doi.org/10.1037/bul0000022>.
- Winsler, A., Deutsch, A., Vorona, R.D., Payne, P.A., Szklo-Coxe, M., 2015. Sleepless in Fairfax: the difference one more hour of sleep can make for teen hopelessness, suicidal ideation, and substance use. *J. Youth Adolesc.* 44, 362–378. <https://doi.org/10.1007/s10964-014-0170-3>.
- Zanarini, M.C., Gunderson, J.G., Frankenburg, F.R., Chauncey, D.L., 1989. The revised diagnostic interview for borderlines: discriminating BPD from other axis II disorders. *J. Pers. Disord.* 3, 10–18. <https://doi.org/10.1521/pedi.1989.3.1.10>.