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Boulevard of broken rhythms: A systematic review and meta-analysis on the relationship between sleep disturbances and suicidal behavior in bipolar disorder

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Abstract

Background. Among the clinical features of bipolar disorder (BD), sleep disturbances are highly prevalent and persist across all phases of the illness, from onset to acute and inter-episodic periods. Substantial evidence suggests that sleep disturbances may function as proximal triggers for suicidal behavior, independent of other underlying psychiatric conditions. Although suicide is a major clinical concern in BD, the interplay between sleep disturbances and suicidality remains incompletely understood.

Methods. We conducted a systematic review and meta-analysis (SRMA) following the PRISMA guidelines. We performed a comprehensive search across PubMed, PsycINFO, and SCOPUS, including all studies reporting an association between sleep disturbances and suicidal behavior in BD. A total of 16 reports, comprising 14 cross-sectional studies and two longitudinal studies, were included in this SRMA.

Results. Among individuals with BD, sleep disturbances were associated with increased odds of lifetime suicidal behaviors (OR = 1.51, 95% CI = 1.23, 1.86), and a history of suicide attempts was associated with significantly elevated odds of experiencing sleep disturbances (OR = 1.37, 95% CI = 1.21, 1.55). In addition, poor sleep quality as measured by the Pittsburgh Sleep Quality Index positively correlated with suicidality (r = 0.24, 95% CI = 0.10, 0.36).

Conclusions. These results highlight the link between sleep disturbances and suicidal tendencies in individuals with BD. Prompt recognition and treatment of sleep disturbances could be crucial for averting or reducing suicidal behaviors in this population.

Introduction

Bipolar disorder (BD) is a chronic and severe illness stemming from the complex interaction between genetic, neurobiological, and environmental factors [1–3]. Among the neurobiological systems altered in BD, sleep/wake and circadian rhythms are affected, showing a strong overlap with disturbances in energy levels that are central to the disorder [4]. Sleep disturbances are part of the diagnostic criteria for BD [5] and structurally contribute to its clinical course and outcome, as they often persist in inter-episodic phases, thus contributing to relapses [6]. They also typically precede the onset of BD [7]. Regrettably, insomnia is often neglected as a symptom target in the management of affective disorders [8].

People with BD present a substantially increased risk of death by suicide, reportedly 10- to 30-fold higher than in the general population [9]. The rate of attempted suicide is also very high, with a lifetime risk of approximately 30%–50% for people with BD [10]. In addition, suicide attempts (SA) are often more lethal in patients with BD than in those with other psychiatric disorders [11]. Suicidal thoughts and behaviors are strongly associated with depressive or mixed mood episodes, and with depressive illness onset [9, 12, 13]. Other established correlates of suicidality include male gender, younger age, age at illness onset, family history of suicide, previous SA, comorbid personality disorders, anxiety disorders, alcohol and substance use, and worse quality of life [9, 14–16].

Notably, sleep disturbances, which are strongly linked to suicidal ideation and behavior in the general population [17], also play the aforementioned, significant role in BD exacerbating mood instability, leading to an increased suicide risk.

Until now, the existing literature on this topic appears unclear due to the often heterogeneous definitions of both sleep disturbances and suicidal outcomes, which may encompass a wide and heterogeneous range of phenomena. Also, a lack of control for relevant confounders complicates the overall understanding of the possible relationship between SA, sleep disturbances, and BD.

This systematic review and meta-analysis addresses this gap by evaluating and quantifying the association between sleep disturbances and suicidality in individuals with BD.

Methods

The current SRMA followed the "Preferred Reporting Items for Systematic Reviews and Meta-Analyses" (PRISMA) 2020 guidelines [18] and a registered protocol (PROSPERO-ID: CRD42023421381). The PRISMA checklist, the original protocol, and detailed deviations from the original protocol are reported in the Supplementary Materials – Appendices 1 and 2.

Search strategy

The PsycINFO, PubMed, and Scopus databases were systematically searched from inception until May 13, 2024 (search strings are available in Supplementary Materials, Appendix 3). The references of the included articles, books, and other pertinent materials were manually searched and inspected to identify additional original studies that were not captured by the search strings.

Eligibility criteria

The inclusion criteria were original articles that: (a) were published in peer-reviewed journals; (b) included individuals diagnosed with BD according to any edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM) [19] or the International Statistical Classification of Diseases and Related Health Problems (ICD) [20]; (c) evaluated sleep disturbances in people with suicidality or suicidality in people with sleep disturbances; and (d) reported quantitative data about these association. Studies were eligible for inclusion if they examined sleep disturbances (e.g., insomnia, nightmares, extended sleep onset latency, wakefulness after sleep onset, reduced total sleep time, decreased sleep efficiency, or poor sleep quality) and suicidality (e.g., ideation, planning, attempts, or completed suicide), regardless of the specific definitions used. Only studies including BD patients as both cases and controls (e.g., BD patients with vs. without sleep disturbances or suicidality) were eligible. Both observational (cross-sectional and longitudinal) and interventional studies were eligible for inclusion, but only baseline data were considered in longitudinal and interventional studies in order to minimize the potential confounding effects of treatment, follow-up duration, and time-varying exposures. No language or age restrictions were applied. Studies were excluded if they were as follows: (a) reviews, clinical cases, abstracts, letters to the editor, conference proceedings, or study protocols; and (b) only included non-human samples.

Study selection and data extraction

After excluding irrelevant articles by title and abstract based on previously defined inclusion and exclusion criteria, potentially eligible articles were examined by reading their full texts. Data extraction included, when available: first author, year of publication, geographical region and country, study design, diagnostic criteria employed and (semi)structured interview used, study setting, age group of participants (categorized as children/adolescents, adults, elderly, or mixed), definition of cases (people with sleep disturbances or people with suicidality) and definition of controls (people without sleep disturbances or people with suicidality), mean age of cases and controls, number and percentage of females in both groups, the number and percentage of individuals diagnosed with BD-I among cases and controls, and the percentage of euthymic, depressed, or (hypo)manic, or mixed patients for cases and controls, pharmacological treatment for both cases and controls, the mean duration of illness and SD for cases and controls, and the percentage of BD familiarity among cases and controls, as well as the percentage of suicide familiarity among cases and controls, broad outcome (suicidality in people with sleep disturbances and sleep disturbances in people with suicidality), specific definition of the outcome (as detailed above), information regarding the time frame of suicidality when available, distinguishing between lifetime suicidality and current suicidality, details regarding the assessment method for suicidality (clinical diagnosis, standardized scale, clinical records), details regarding the assessment method for sleep disturbance (self-report, validated scale, or objective measures such as polysomnography (PSG) or actigraphy), number of individuals with and without sleep disturbances or number of individuals with or without suicidality, mean scores and standard deviation (SD) obtained on severity scale for the outcome of interest for cases and controls, statistics that quantify association between outcomes and predictors (correlation coefficients, odds ratios (ORs), or standardized mean differences (SMDs)). When information was not available, we contacted the authors to request relevant data.

Two investigators (CP and MB) conducted all steps described independently. Discrepancies were resolved by consensus with the third author (VO or MDP).

Quality control

Two investigators (CP and MB) independently assessed the Risk of Bias using the "Newcastle-Ottawa Scale" (NOS) [21]. Discrepancies were resolved by consensus with the third author (VO or MDP). The obtained scores were converted according to the standards set by the "Agency for Healthcare Research and Quality" (AHRQ) as previously described [22].

Statistical analysis

Statistical analyses were conducted using R version 4.3.1 [23], and separate random-effect meta-analyses (restricted maximum-likelihood estimator) [24] were performed using the metaphor R-package [25]. SMDs, ORs, and Pearson's r coefficients with 95% confidence intervals (CI) were used to calculate effect sizes for continuous and dichotomous outcomes and correlations, respectively.

The results were visualized using jungle plots, which display SMDs, ORs, correlation coefficients, and 95% CI for each outcome [26].

Heterogeneity was evaluated using Cochran's Q test and I^2 statistic. If heterogeneity was detected (Cochran's Q p-value < 0.10 or $I^2 > 50\%$), meta-regressions were conducted according to predefined predictors (i.e., mean age, percentage of females, percentage of BD-I, percentage of euthymic patients, percentage of patients with depressive episode, and percentage of patients with (hypo-)manic episode).

Leave-one-out sensitivity analysis, excluding one study at a time from the main analysis, was used to investigate the influence of each study on the overall effect size estimation. Publication bias was examined using funnel plots and Egger's test [27] when at least 10 studies were available.

Results

Study characteristics

The overall study selection process is shown in the PRISMA flowchart in Figure 1. The literature search identified 828 records, which became 714 after supervised removal of duplicates. Of these, 652 were excluded from the title and abstract screening, and 46 were excluded after reading the full text. Sixteen studies [28–43] fulfilled our inclusion criteria and were included in the quantitative synthesis. A comprehensive list of the excluded studies, with the respective reasons for their exclusion, is provided in the Supplementary Materials – Appendix 4.

The included studies were published between 2012 and 2022, with six studies from Europe, five from North America, two from Asia, two from Africa, and one multicenter study (i.e., from multiple sites in Europe, Africa, and the Middle East). Fourteen studies used a cross-sectional design, and two studies were longitudinal [31, 43]. The sample sizes across the studies varied from 8 to 16,411, encompassing a total of 19,084 individuals with BD. A comprehensive overview of the included studies is provided in Table 1.

For a thorough understanding of the scales used to assess suicidality and sleep disturbances included in the quantitative analysis, and additional information such as illness duration, family history of suicide and psychiatric disorders, and current treatment, please refer to Supplementary Materials – Appendices 5 and 6.

Suicidality in patients with BD and sleep disturbances

A total of 11 studies [28, 32, 33, 36–43] on patients with sleep disturbances were included, comprising a total of 18,420 participants (3,692 cases and 14,728 controls). The overall mean age was 36.25 years (SD = 18.88), and 56.73% of the participants were female.

Three studies evaluated sleep quality using validated scales [28, 33, 36]. Three studies assessed general sleep disturbances, with one using a validated scale [43] and two relying on clinical

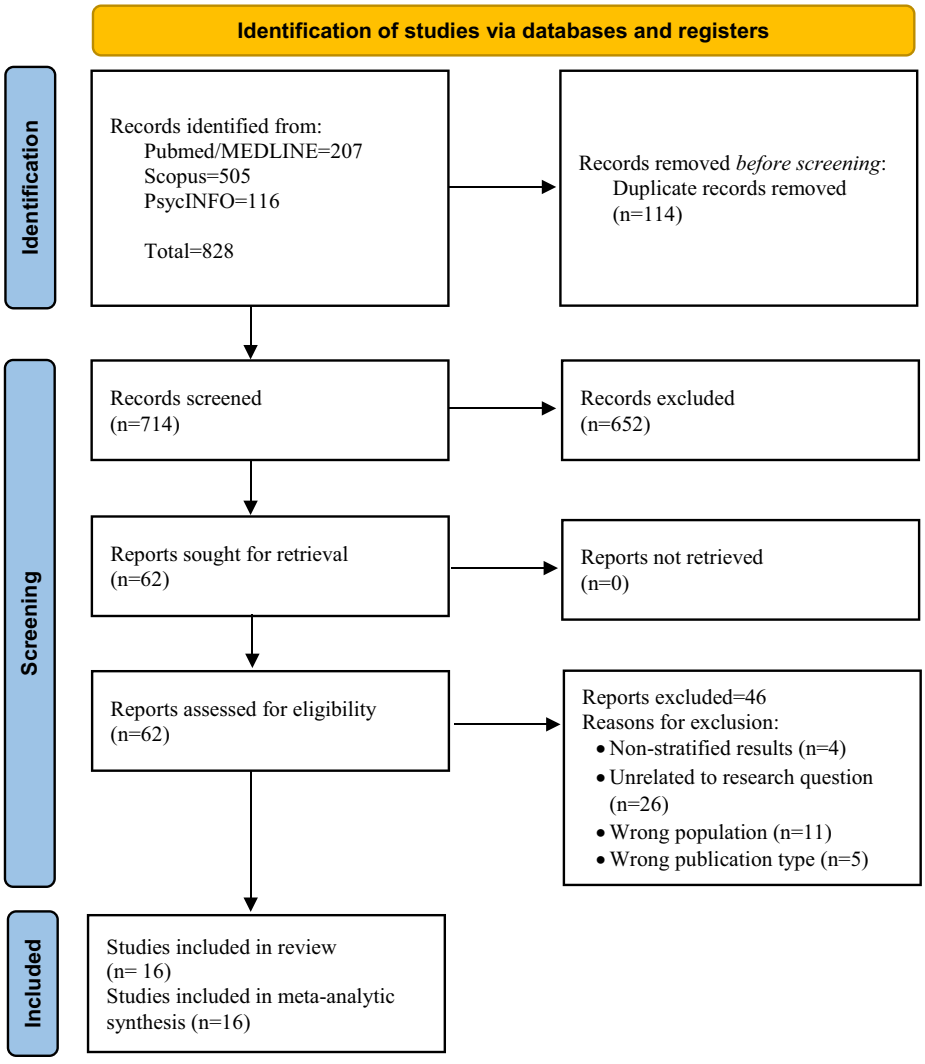

Figure 1. PRISMA flowchart, 2020 edition, adapted.

Table 1. Characteristics of the studies included in the systematic review and meta-analysis

Author, year, country	Study design	Setting	Diagnostic criteria	N (BD I %)		Mood state (%)		Mean age ± SD % of females		Sleep assessment	Suicidality assessment	Outcome	Effect measures	Quality of the study (NOS)
				Cases[a]	Controls[a]	Cases[a]	Controls[a]	Cases[a]	Controls[a]					
Aubert et al. (2016) [28], France	Cross-sectional	Outpatients	DSM-IV (SCID)	199 (46.23%)	294 (60.88%)	Euthymic (100%)	Euthymic (100%)	46 57.29%	43 54.76%	Actual sleep quality (PSQI)	Lifetime suicidality (clinical)	Suicidality	OR	6 (GOOD)
Benard et al. (2019) [29], France	Cross-sectional	Outpatients	DSM-IV (DIGS/ SCID)	57 (72%)	90 (77%)	Euthymic (100%)	Euthymic (100%)	47.24 ± 12.63 72%	44.77 ± 12.95 54%	Sleep problems (PSQI, Berlin Questionnaire, ESS, Actigraphy fragmentation index)	Lifetime suicidal attempts (clinical)	Sleep problems	OR, SMD	6 (GOOD)
Bernert et al. (2017) [30], USA	Cross-sectional	NA	DSM-IV (SCID)	24 (NA)		Depressed (100%)		44.4 ± 11.6 70.7%		Actual sleep duration (PSG-TST)	Actual suicidal ideation (HAM-D item 3)	–	Correlation	4 (POOR)
Bertrand et al. (2020) [31], Canada	Longitudinal	Outpatients	DSM-V	76 (53%)		Euthymic (50%) Hypomanic (3.95%) Mixed (7.89%) Depressed (38%)		49 37.49%		Actual insomnia (AIS sleep, Actigraphy-TST)	Actual suicidal ideation (C-SSRS)	–	Correlation	6 (POOR)
Bishop et al. (2020) [32], USA	Cross-sectional	Outpatients	ICD–9	2212 (NA)	14199 (NA)	NA	NA	NA NA	NA NA	Actual sleep problems (clinical)	Actual suicidal attempts (register)	Suicidality	OR[a]	8 (GOOD)
				13308	3103	NA	NA	48.23 15.46%	50.01 16.37%			Sleep problems	OR	
Esan and Fela-Thomas (2022) [33], Nigeria	Cross-sectional	Outpatients	DSM-IV (SCID)	37 (100%)	39 (100%)	Euthymic (100%)	Euthymic (100%)	38.49 ± 11.2 66.7%	39.67 ± 11.1 58.6%	Actual sleep problems (PSQI)	Lifetime and actual suicidal attempts (clinical)	Suicidality	OR	6 (FAIR)
Fekih-Romdhane et al. (2019) [34], Tunisia	Cross-sectional	Outpatients	DSM-V	47 (100%)	61 (100%)	Euthymic (100%)	Euthymic (100%)	NA NA	NA NA	Actual daytime sleepiness (ESS), actual sleep quality (PSQI)	Lifetime suicidal attempts (clinical), actual suicidal ideation (HAM-D item)	Sleep problems	SMD	6 (FAIR)
				108 (100%)		Euthymic (100%)		41.8 ± 12.2 36.1%		Actual sleep quality (PSQI)	Actual suicidal ideation (HAM-D item)	–	Correlation	
Hashmi et al. (2023) [35], Pakistan	Cross-sectional	Outpatients	ICD–10	222 (92.8%)		NA		30.47 ± 11.43 41%		Actual insomnia (clinical)	Actual suicidality (clinical)	–	Correlation	4 (POOR)
Keskin, Tamam, and Ozpoyraz (2018) [36], Turkey	Cross-sectional	Outpatients	DSM-IV-TR (SCID)	69 (78.3%)	53 (90.6%)	Euthymic (100%)	Euthymic (100%)	39.2 ± 10.5 60.9%	38 ± 11.3 67.9%	Sleep quality (PSQI)	Lifetime suicidal attempts (clinical)	Suicidality	OR	6 (FAIR)
Marinova et al. (2014) [37], Bulgaria	Cross-sectional	Inpatients	ICD–10	2	6	Depressed (100%)	Depressed (100%)	NA NA	NA NA	Nightmares (clinical)	Lifetime suicidal attempts (clinical), actual suicidality (HAM-D item)	Suicidality	OR	5 (POOR)
Murru et al. (2019) [38], Spain, Bulgaria, Egypt, Morocco, Netherlands, Portugal, Russia, Turkey	Cross-sectional	Outpatients/ Inpatients	DSM-V, RDC	377 (NA)	44 (NA)	Depressed (100%)	Depressed (100%)	41.59 ± 12.98 66.31%	46.98 ± 12.62 65.9%	Insomnia/Hypersomnia (clinical)	Lifetime suicidal attempts (clinical)	Suicidality	SMD	8 (GOOD)

Continued

Author, year, country	Study design	Setting	Diagnostic criteria	N (BD I %)		Mood state (%)		Mean age ± SD % of females		Sleep assessment	Suicidality assessment	Outcome	Effect measures	Quality of the study (NOS)
				Cases[a]	Controls[a]	Cases[a]	Controls[a]	Cases [a]	Controls[a]					
Palagini et al. (2019) [39], Italy	Cross-sectional	Inpatients	DSM-V (SCID)	54 (0%)	23 (0%)	Depressed Mixed (100%)	Depressed Mixed (100%)	47.6 ± 12 62.3%	50.3 ± 13 63.8%	Actual insomnia (ISI)	Actual suicidality (SSI)	Suicidality	SMD	6 (FAIR)
				77 (0%)		Depressed/Mixed (100%)		48.4 ± 12.4 36.1%				–	Correlation	
Palagini et al. (2022) [40], Italy	Cross-sectional	Inpatients	DSM-V (SCID)	188 (48.9%)		Depressed (100%)		46.4 ± 13 43%		Actual insomnia (ISI)	Actual suicidality (SSI)	Suicidality	SMD	7 (GOOD)
												–	Correlation	
Stanley et al. (2017) [41], USA	Cross-sectional	NA	DSM-IV	379 (100%)		Manic (100%)		10.2 ± 2.7 53.8%		Actual nightmares (WASH-U-KSADS)	Actual suicidality (CDRS-R item 13)	Suicidality	OR	5 (POOR)
Stubbs et al. (2016) [42], UK	Cross-sectional	Outpatients	DSM-IV	259 (NA)		NA		NA NA		Actual sleep problems (clinical)	Actual suicidal ideation (clinical)	Suicidality	OR[a]	5 (FAIR)
Sylvia et al. (2012) [43], USA	Longitudinal	Outpatients	DSM-IV (SCID)	73 (72.2%)		Euthymic (100%)		43.18 ± 12.98 63.9%		Actual sleep problems (MADRS item 4)	Lifetime suicidal attempts (clinical)	Suicidality	OR[a]	6 (FAIR)

Abbreviations: AIS, abbreviated injury scale; BD, bipolar disorder; CDRS-R, Children's Depression Rating Scale-Revised; C-SSRS, Columbia suicide severity rating scale; DIGS, diagnostic interview for genetic studies; DSM, diagnostic and statistical manual of mental disorders; ESS, Epworth Sleepiness Scale; HAM-D, Hamilton Depression Rating Scale; ICD, International Statistical Classification of Diseases and Related Health Problems; ISI, Insomnia Severity Index; MADRS, Montgomery Asberg Depression Rating Scale; NOS, Newcastle–Ottawa scale; PSG-TST, polisomnography-total sleep time; PSQI - Pittsburgh Sleep Quality Index; SCID, Structured Clinical Interview for DSM Disorders; SSI, Scale for Suicide Ideation; WASH-U-KSADS, Washington University in St. Louis Kiddie Schedule for Affective Disorders and Schizophrenia.
[a]Results only with the point estimate of the odds ratio.

assessment [32, 42]. Regarding insomnia, two studies used validated scales [39, 40], while one study assessed insomnia and hypersomnia clinically [38]. Two studies focused exclusively on nightmares, one with a clinical assessment and the other with a validated scale [37, 41]. Six studies clinically evaluated suicidal ideation or attempts [28, 33, 36, 38, 42, 43], considering both lifetime and current instances. Four studies assessed current suicidality using validated scales [37, 39–41]. One study used medical records to assess completed suicides [32].

According to the NOS scale, four studies were rated as "Good," five as "Fair," and two as "Poor." For more information, please refer to Supplementary Material – Appendix 7.

Sleep disturbances in patients with BD and suicidality

Three studies [29, 32, 34] focusing on BD patients with suicidality (either current or lifetime) were included. The total number of participants was 16,666 (13,412 cases and 3,254 controls). The overall mean age was 48 years (SD = 11.2), with 57% female participants.

Two out of the three studies clinically assessed lifetime suicidality [29, 34]. One study evaluated current suicidal ideation using a validated scale [34]. Another study consulted medical records for suicide attempts [32]. Two studies assessed sleep using validated scales [29, 34], one of them used actigraphy data [29], and the third one used clinical assessment without scales [32].

Two studies were rated as "Good" quality and one as "Fair." For more information, please refer to Supplementary Material – Appendix 7.

Correlations between sleep disturbances and suicidality

Three studies reported correlation data between sleep disturbances and suicidality [30, 31, 35], with a total sample size of 322 participants. The mean age was 35.98 years (SD = 12.83), and 42.37% were female. Two studies provided objective sleep data using actigraphy and polysomnography [30, 31], while suicidality was assessed using validated clinical scales. The quality of the three studies was rated as "Poor."

Meta-analyses results

The main meta-analytic results are presented in Table 2. Jungle plots of the main results are presented in Figure 2. Forest plots and further details of the leave-one-out sensitivity analyses and meta-regressions are reported in Supplementary Materials – Appendix 8.

Suicidality in patients with BD and sleep disturbances

Lifetime suicidality. Sleep disturbances were associated with significantly higher lifetime suicidality (OR = 1.51, 95% CI = 1.23, 1.86, p-value <0.001, I^2 = 20.1%). The leave-one-out sensitivity analysis did not show a significant influence of single studies on the overall results.

Current suicidality. No significant results were observed (OR = 2.52, 95% CI = 0.93, 6.81, p-value = 0.07, I^2 = 36.1%). The meta-analysis became significant when two studies were excluded in the leave-one-out sensitivity analysis.

Suicidality scores on assessment scales. Patients with sleep disturbances presented significantly higher scores at suicidality assessment scales (SMD = 0.79, 95% CI = 0.53, 1.05, p-value <0.01, I^2 = 0%).

Sleep disturbances in patients with BD and suicidality

Current sleep disturbances. SA were significantly associated with the presence of sleep disturbances (OR = 1.37, 95% CI = 1.2, 1.55, p-value <0.01, I^2 = 0%).

Daytime sleepiness. No significant association was observed between suicide attempts and daytime sleepiness measured by the Epworth scale (ESS; SMD = −0.12, 95% CI = −0.44, 0.21, p-value = 0.49, I^2 = 39.8%).

Sleep quality. Poorer sleep quality, measured by the Pittsburgh Sleep Quality Index (PSQI), was significantly associated with SAs (SMD = 0.42, 95% CI = 0.12, 0.73, p-value <0.01, I^2 = 30.9%).

Correlations between sleep disturbances and suicidality

Association between sleep quality and suicidal ideation. A significant positive correlation was found (r = 0.24, 95% CI = 0.10, 0.36, p-value <0.01, I^2 = 66.67%). Leave-one-out sensitivity analysis did not show a significant influence of single studies on the overall results. Meta-regression analyses indicated a significant dependence on age (β = 0.014, 95% CI = 0.001, 0.028, p-value = 0.05). No significant differences were observed in terms of gender, bipolar disorder diagnosis, or affective state.

Association between total sleep time and suicidal ideation. No significant correlation between suicidal ideation and total hours of sleep in BD was identified (r = 0.06, 95% CI: −0.29, 0.41, p-value = 0.73, I^2 = 58.6%).

Publication bias

Since none of the meta-analyses included a minimum of 10 studies, publication bias could not be assessed [44].

Discussion

The present SRMA aimed to assess the association between sleep disturbances and suicidality in individuals diagnosed with BD. Overall, we found a significant association between sleep disturbances and suicidality in BD in both directions: individuals with BD who report sleep disturbances (i.e., insomnia, hypersomnia, nightmares) have increased odds of suicidal behavior (lifetime suicidal attempts or suicidal ideation), while those with a history of suicide attempts are more likely to experience sleep disturbances. Additionally, poor sleep quality, as measured with PSQI, positively correlated with suicidal ideation and SAs.

Our findings align with previous SRMAs conducted in populations with unipolar major depression [45], as well as in other psychiatric diagnoses such as schizophrenia, anxiety, panic disorder [46, 47], and in the general population [48, 49], where sleep disturbances were consistently linked to suicidality.

In BD, both insomnia and hypersomnia are clinically relevant. While insomnia is often the focus of suicide risk, hypersomnia, a common feature of atypical depression, is frequently underestimated [50]. Atypical depressive features are more prevalent in BD and have been associated with increased suicide risk [51]. Additionally, hypersomnia in BD is also linked with increased illness severity, a higher frequency of mood episodes, prolonged depressive or (hypo)manic phases, and psychiatric comorbidities [38]. Furthermore, genetic studies suggest that both suicidality and

Table 2. Results of the meta-analyses in detail

Outcome	Studies, *n*	Cases, *n*	Controls, *n*	OR	SMD	Corr	95% CIs	*p*-value	95% PIs	I^2(%)	τ^2	*Q* test *p*-value
Suicidality in patients with BD and sleep disturbances												
Lifetime suicidality	7	2969	14605	1.51			1.23, 1.86	**0**	0.09, 0.74	20.1	0.02	0.37
Current suicidality	4	677	45	2.52			0.93, 6.81	0.07	0.52, 12.13	36.08	0.39	0.19
Suicidality scores	2	172	93		0.79		0.53, 1.05	**3.53E−09**	0.53, 1.05	0	0	0.64
Sleep disturbances in patients with BD and suicidality												
Current sleep disturbances	2	13365	3193	1.37			1.21, 1.55	**3.75E−07**	1.21, 1.55	0	0	0.33
Daytime sleepiness	2	104	151		−0.12		−0.44, 0.21	0.49	−0.55, 0.32	39.8	0.02	0.20
Sleep quality	2	104	151		0.42		0.12, 0.73	**6.59E−03**	0.34, 0.81	30.93	0.02	0.23
Correlations between sleep disturbances and suicidality												
Sleep quality – Suicidal ideation	5	671				0.24	0.10, 0.36	**6.27E−04**	−0.04, 0.53	66.67	0.02	0.01
Total sleep time – Suicidal ideation	2	100				0.06	−0.29, 0.41	0.73	−0.48, 0.61	58.6	0.04	0.12

Abbreviations: CIs, confidence intervals; I^2, Higgin and Thompson's I^2 estimating of the total heterogeneity; PIs, prediction intervals; *Q p*, *p*-value for the Cochran's *Q*-test of (residual) heterogeneity; OR, odds ratio; SMD, standardized mean difference; τ^2, between-study variance.
Significant results are depicted in bold.

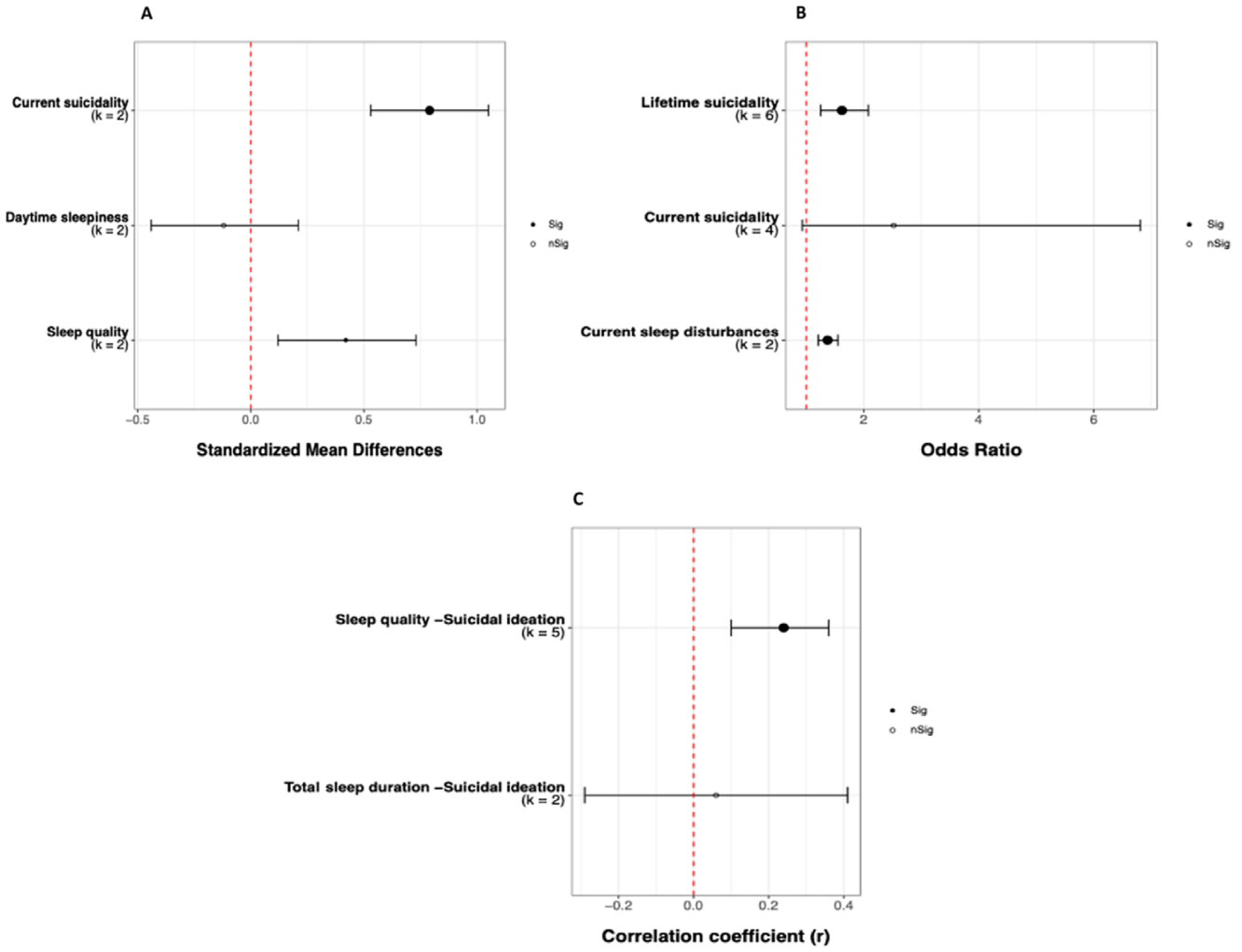

Figure 2. Jungle plots summarizing the main effect sizes: (A) Odds ratios (OR), (B) Standardized mean differences (SMD), (C) Correlation coefficients. Black-filled dots represent statistically significant comparisons, while white-filled dots indicate non-significant comparisons. Dot size corresponds to the sample size of each comparison.

hypersomnia may share underlying proinflammatory pathways [52]. Thus, despite hypersomnia being perceived as a less worrisome symptom when assessing suicide risk, it still should be routinely evaluated [53].

Interestingly, individuals with atypical depression may also exhibit elevated levels of emotion dysregulation [54]. Emotion dysregulation is a transdiagnostic construct characterized by difficulty in understanding, accepting, and regulating emotions [55, 56]. It is highly prevalent in BD and correlates with both depressive and (hypo)manic symptoms [57]. Emotion dysregulation worsens when sleep disturbances are present, increasing impulsivity and elevating the risk of suicide [58]. More precisely, rumination is the emotion regulation strategy most strongly associated with symptoms of BD [59], mediating between sleep and suicidality [60]. In line with this, neuroimaging studies support that sleep deprivation disrupts emotion-regulating neural circuits, while heightened emotional arousal negatively affects sleep [61]. So, emotion dysregulation would act as a state-dependent and sleep-dependent factor increasing the vulnerability to suicidal behavior, particularly in BD, where impulsivity and risk-taking are core and prevalent features [39, 62]. In addition to these state-dependent factors, individuals with BD also present stable, trait-like factors (i.e., affective temperaments) contributing to the likelihood of suicide. Temperaments such as irritable, cyclothymic, depressive, and anxious have been associated with impulsivity and mood instability [63–65]. These characteristics may interact with environmental stressors such as sleep disturbances, exacerbating emotion dysregulation and promoting both self- and hetero-aggressive behaviors.

Along with sleep disturbances, broader circadian rhythm disruption represents another key trait-related framework in BD.

Circadian rhythms are regulated by feedback loops involving the commonly defined "clock genes" [63], which orchestrate not only the sleep–wake cycle but also metabolic and neurophysiological processes [64, 65]. Polymorphic variations in clock genes are significantly associated with BD [66, 67], and linked to greater severity and recurrence of mood episodes [68–70]. Importantly, several clock genes relate to key biomarkers for the prediction of suicidality [71], such as *CLOCK* and *ARNTL* (also known as *BMAL1*). Animal studies reinforce this connection: in CLOCK mutant rodents, circadian disruption is associated with increased activity in the ventral tegmental area, leading to manic-like behaviors [72]. This circadian misalignment alters dopamine dysregulation, representing a possible neurobiological substrate for suicidality in BD [73].

Although our SRMA did not reveal significant differences between BD-I and BD-II in terms of sleep disturbances and suicidality, prior

literature suggests that they may differ in relevant clinical features, including patterns of sleep dysregulation and risk profiles for suicidal behavior. In BD-I, suicide risk has been more consistently associated with insomnia, particularly difficulties initiating sleep and associated daytime impairments such as anhedonia [74]. Some studies also report higher rates of hypersomnia in BD-I, which may reflect a real clinical feature, measurement limitations in detecting hypersomnia, or treatment-related aspects [75]. Conversely, in BD-II, suicide risk appears more strongly linked to evening chronotype, emotional dysregulation, childhood trauma, and low resilience [76]. This pattern aligns with the circadian vulnerability model, in which eveningness constitutes a transdiagnostic marker of emotional instability [77]. Finally, the presence of mixed features across BD subtypes is consistently associated with more severe clinical outcomes, including rapid cycling, substance use comorbidity, and elevated suicide risk [13].

Another aspect to take into account in the relationship between sleep and suicidality in BD is the potential moderating role of age. Our meta-regression analysis indicated that the association between poor sleep quality and suicidality becomes stronger with increasing age. This pattern aligns with prior longitudinal and clinical studies emphasizing the relevance of sleep disturbances in suicide risk among older adults [78], possibly due to the cumulative burden of chronic sleep disruption, comorbid medical conditions, or reduced resilience.

According to our results, sleep contributes to shaping the clinical cascade leading to suicidal behavior in BD, so that their early detection is crucial. Clinicians must not underestimate any complaints and should always thoroughly explore sleep patterns, ideally with validated scales. Prospective, real-time monitoring of sleep, circadian rhythms has the potential to enhance standard clinical care in the near future. The use of technology and wearable devices alongside ecological momentary assessment tools (e.g., mobile-based self-report systems) offers a promising approach to accurately catch sleep, energy, and mood fluctuations [79].

Although treatment considerations fall outside the scope of this review, the clinical relevance of managing sleep disturbances in the context of suicidality in BD warrants some consideration. Lithium remains the most robust pharmacological agent with dual effects on sleep regulation and suicide prevention [53, 80]. A syndrome-based pharmacological approach, tackling both sleep and mood fluctuations, seems the most rational approach to sleep alterations in BD, so that the same considerations in the general management of BD are due, such as caution in the use of antidepressants and the unwarranted use of benzodiazepines for chronic insomnia [2, 81, 82]. Non-pharmacological interventions such as sleep hygiene education, light therapy, and cognitive-behavioral therapy for insomnia (CBT-I) may complement standard treatment in BD [83, 84].

Limitations

The present SRMA is the first to examine the relation between sleep disturbances and suicidality in individuals with BD. Our results must be considered in the light of some limitations.

The most important limitation is the overall scarcity of prospective studies on the topic, and only two longitudinal studies were included, so that while this SRMA univocally supports an association between sleep disturbances and suicidality in BD, the directionality of this relationship remains unclear. Undoubtedly, sleep disturbances act as proximal triggers anticipating suicidal behaviors, but they might also arise as downstream effects of depressive symptoms or other clinical aspects.

These limitations reflect a technological barrier that digital tools for ecological and continuous monitoring will hopefully help to bypass [85]. Furthermore, the evidence reviewed in this study could not differentiate between acute and euthymic phases of the disorder or finer aspects in the clinical course, such as the predominant polarity of relapses. Also, most of the studies lack the control for comorbid somatic, psychiatric, and substance use confounding conditions, which are all well-known factors associated with sleep disturbances and suicidality in general populations and in individuals with BD [86–88]. Comorbid sleep disorders are especially relevant, unconsidered, and underdiagnosed in psychiatric populations [89]. Additionally, the majority of the patients in the included studies were on medication, and its effects on sleep and suicidality may be a confounder [90]. Lastly, the lack of ethnic data restricts the generalizability of our findings, as the relationship between sleep disturbances and suicidal behavior in BD may vary across different ethnic and environmental contexts, as suggestive evidence exists on the association of high temperature and suicidal behaviors [91].

Future research should aim to improve methodological rigor – particularly through the use of more prospective designs – and incorporate ecological, continuous assessments of sleep and activity patterns, which might allow for differentiating the broad definition of sleep disturbances into a meaningful and clinically relevant stratification [92–94]. This temporal distinction is clinically meaningful, as it informs whether sleep interventions may serve a preventive versus palliative function in suicide risk management. Integrating this bidirectional model into clinical frameworks could help both refine and redefine screening and treatment priorities.

Conclusions

This systematic review and meta-analysis found a significant association between sleep disturbances and suicidality in individuals with bipolar disorder, with the most consistent relationship observed between poor sleep quality and suicidal ideation. Future studies using standardized, multidimensional assessments of sleep and prospective designs are needed to clarify the temporal and physiopathological links between sleep alterations and suicidality in bipolar disorder, and digital innovation will likely allow us to fill this gap both in research and clinical practice. Nonetheless, integrating structured sleep assessment into routine care may offer clinicians a practical and accessible opportunity to improve monitoring, guide timely interventions, and ultimately enhance the safety and well-being of individuals living with bipolar disorder.

Supplementary material. The supplementary material for this article can be found at http://doi.org/10.1192/j.eurpsy.2025.10102.

Data availability statement. Requests to see any data that are not included in the article or the appendix should be directed to the corresponding author.

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References

[1] Fico G et al. The U-shaped relationship between parental age and the risk of bipolar disorder in the offspring: A systematic review and meta-analysis. Eur Neuropsychopharmacol. 2022;60:55–75.
[2] Vieta E et al. Bipolar disorders. Nat Rev Dis Prim. 2018;4(1):1–16.
[3] Oliva V et al. Bipolar disorders: An update on critical aspects. Lancet Reg Health Eur. 2024;48:101135. doi: 10.1016/j.lanepe.2024.101135. eCollection 2025 Jan. PMID: 39811787
[4] McCarthy MJ et al. Neurobiological and behavioral mechanisms of circadian rhythm disruption in bipolar disorder: A critical multi-disciplinary literature review and agenda for future research from the ISBD task force on chronobiology. Bipolar Disord. 2022;24(3):232–63.
[5] American Psychiatric Association, *Diagnostic and statistical manual of mental disorders*. Am Psychiatric Assoc. 2013;21(21):591–643.
[6] Gold AK and LG Sylvia The role of sleep in bipolar disorder. Nature and Science of Sleep. 2016;8(null) 207–14.
[7] Pancheri C et al. A systematic review on sleep alterations anticipating the onset of bipolar disorder. Eur Psychiatry. 2019;58:45–53.
[8] Murru A, Sommerhoff C. First, thou shall not chronicize: The risk of untreated insomnia. Eur Neuropsychopharmacol. 2024;83:56.
[9] Schaffer A et al. International Society for Bipolar Disorders Task Force on suicide: Meta-analyses and meta-regression of correlates of suicide attempts and suicide deaths in bipolar disorder. Bipolar Disord. 2015;17(1):1–16.
[10] Dong M et al. Prevalence of suicide attempts in bipolar disorder: A systematic review and meta-analysis of observational studies. Epidemiol Psychiatr Sci. 2020;29:e63.
[11] Baldessarini RJ, Tondo L. Suicidal risks in 12 DSM-5 Psychiatric disorders. J Affect Disord. 2020;271:66–73.
[12] Plans L et al. Completed suicide in bipolar disorder patients: A cohort study after first hospitalization. J Affect Disord. 2019;257:340–4.
[13] Tondo L, GH Vazquez and RJ Baldessarini Suicidal behavior associated with mixed features in major mood disorders. Psychiatric Clin North Am. 2020. 43(1) 83–93.
[14] Liu RT et al. Sleep and suicide: A systematic review and meta-analysis of longitudinal studies. Clin Psychol Rev. 2020;81:101895.
[15] Weiss S et al. Gender differences in suicidal risk factors among individuals with mood disorders. J Depress Anxiety. 2016;5(218):2167.
[16] Oliva V et al. Anxious and depressive symptoms and health-related quality of life in a cohort of people who recently attempted suicide: A network analysis. J Affect Disord. 2024;355:210–9.
[17] Pigeon WR, Titus CE, Bishop TM. The relationship of suicidal thoughts and behaviors to sleep disturbance: A review of recent findings. Curr Sleep Med Rep. 2016;2(4):241–50.
[18] Page MJ et al. PRISMA 2020 explanation and elaboration: Updated guidance and exemplars for reporting systematic reviews. BMJ. 2021;372.
[19] American Psychiatric Association D, Association AP. Diagnostic and statistical manual of mental disorders: DSM-5. Vol. 5. Washington, DC: American psychiatric association; 2013.
[20] World Health Organization. International Classification of Diseases eleventh revision (ICD-11). Geneva, Switzerland; 2022.
[21] Stang A. Critical evaluation of the Newcastle-Ottawa scale for the assessment of the quality of nonrandomized studies in meta-analyses. Eur J Epidemiol. 2010;25(9):603–5.
[22] De Prisco M et al. Clinical features in co-occuring obsessive-compulsive disorder and bipolar disorder: A systematic review and meta-analysis. Eur Neuropsychopharmacol. 2024;80:14–24.
[23] RStudio Team. RStudio: Integrated development for R [Internet]. Boston, MA: RStudio, PBC; 2020. Available from: https://www.rstudio.com/
[24] Harville DA. Maximum likelihood approaches to variance component estimation and to related problems. J Am Stat Assoc. 1977;72(358):320–38.
[25] Viechtbauer W. Conducting meta-analyses in R with the metafor package. J Stat Softw. 2010;36:1–48.
[26] De Prisco M, Oliva V. Welcome to the jungle plot: An open letter to improve data visualization in meta-analyses. Eur Neuropsychopharmacol. 2024;89:12.
[27] Egger M et al. Bias in meta-analysis detected by a simple, graphical test. BMJ. 1997;315(7109):629–34.
[28] Aubert E et al. Effect of early trauma on the sleep quality of euthymic bipolar patients. J Affect Disord. 2016;206:261–7.
[29] Benard V et al. Sleep and circadian rhythms as possible trait markers of suicide attempt in bipolar disorders: An actigraphy study. J Affect Disord. 2019;244:1–8.
[30] Bernert RA et al. Sleep architecture parameters as a putative biomarker of suicidal ideation in treatment-resistant depression. J Affect Disord. 2017;208:309–15.
[31] Bertrand L et al. Suicidal ideation and insomnia in bipolar disorders: Ideation suicidaire et insomnie dans les troubles bipolaires. Can J Psychiatr. 2020;65(11):802–10.
[32] Bishop TM et al. Sleep, suicide behaviors, and the protective role of sleep medicine. Sleep Med. 2020;66:264–70.
[33] Esan O, Fela-Thomas A. The significance of sleep quality in euthymic bipolar patients from Nigeria. S Afr J Psychiatry. 2022;28:1617.
[34] Fekih-Romdhane F et al. The link between sleep disturbances and suicidal thoughts and behaviors in remitted bipolar I patients. J Clin Psychol. 2019;75(9):1643–57.
[35] Hashmi AN et al. Contributing risk factors of common psychiatric disorders in the Pakistani population. Eur Arch Psychiatry Clin Neurosci. 2023;273(4):963–81.
[36] Keskin N, Tamam L, Ozpoyraz N. Assessment of sleep quality in bipolar euthymic patients. Compr Psychiatry. 2018;80:116–25.
[37] Marinova P et al. Nightmares and suicide: Predicting risk in depression. Psychiatr Danub. 2014;26(2):159–64.
[38] Murru A et al. The implications of hypersomnia in the context of major depression: Results from a large, international, observational study. Eur Neuropsychopharmacol. 2019;29(4):471–81.
[39] Palagini L et al. Insomnia symptoms predict emotional dysregulation, impulsivity and suicidality in depressive bipolar II patients with mixed features. Compr Psychiatry. 2019;89:46–51.

[40] Palagini L et al. Insomnia symptoms are associated with impaired resilience in bipolar disorder: Potential links with early life stressors may affect mood features and suicidal risk. J Affect Disord. 2022;299:596–603.
[41] Stanley IH et al. Comorbid sleep disorders and suicide risk among children and adolescents with bipolar disorder. J Psychiatr Res. 2017;95:54–9.
[42] Stubbs B et al. A population study of the association between sleep disturbance and suicidal behaviour in people with mental illness. J Psychiatr Res. 2016;82:149–54.
[43] Sylvia LG et al. Sleep disturbance in euthymic bipolar patients. J Psychopharmacol. 2012;26(8):1108–12.
[44] Higgins J. *Cochrane handbook for systematic reviews of interventions. Version 5.1. 0 [updated March 2011]. The Cochrane Collaboration.* www.cochrane-handbook.org, 2011.
[45] Wang X, Cheng S, Xu H. Systematic review and meta-analysis of the relationship between sleep disorders and suicidal behaviour in patients with depression. BMC Psychiatry. 2019;19(1):303.
[46] Malik S et al. The association between sleep disturbances and suicidal behaviors in patients with psychiatric diagnoses: A systematic review and meta-analysis. Syst Rev. 2014;3(1):1.
[47] Rogers E, Gresswell M, Durrant S. The relationship between sleep and suicidality in schizophrenia spectrum and other psychotic disorders: A systematic review. Schizophr Res. 2023;261:291–303.
[48] Harris LM et al. Sleep disturbances as risk factors for suicidal thoughts and behaviours: A meta-analysis of longitudinal studies. Sci Rep. 2020;10(1):13888.
[49] Baldini V et al. Association between sleep disturbances and suicidal behavior in adolescents: A systematic review and meta-analysis. Front Psych. 2024;15:1341686.
[50] Barateau L et al. Hypersomnolence, hypersomnia, and mood disorders. Curr Psychiatry Rep. 2017;19(2):13.
[51] Sánchez-Gistau V et al. Atypical depression is associated with suicide attempt in bipolar disorder. Acta Psychiatr Scand. 2009;120(1):30–6.
[52] Kappelmann N et al. Dissecting the Association between inflammation, metabolic dysregulation, and specific depressive symptoms: A genetic correlation and 2-sample mendelian randomization study. JAMA Psychiatry. 2021;78(2):161–70.
[53] Yan X, Xu P, Sun X. Circadian rhythm disruptions: A possible link of bipolar disorder and endocrine comorbidities. Front Psych. 2022;13:1065754.
[54] Fornaro M et al. Atypical depression and emotion dysregulation: Clinical and psychopathological features. J Affect Disord. 2025;376:410–21.
[55] De Prisco M et al. Defining clinical characteristics of emotion dysregulation in bipolar disorder: A systematic review and meta-analysis. Neurosci Biobehav Rev. 2022;142:104914.
[56] De Prisco M et al. Emotion dysregulation in bipolar disorder compared to other mental illnesses: A systematic review and meta-analysis. Psychol Med. 2023;53(16):7484–503.
[57] Oliva V et al. Correlation between emotion dysregulation and mood symptoms of bipolar disorder: A systematic review and meta-analysis. Acta Psychiatr Scand. 2023;148(6):472–90.
[58] Harvey AG et al. Sleep disturbance as transdiagnostic: Consideration of neurobiological mechanisms. Clin Psychol Rev. 2011;31(2):225–35.
[59] Oliva V et al. Highest correlations between emotion regulation strategies and mood symptoms in bipolar disorder: A systematic review and Bayesian network meta-analysis. Neurosci Biobehav Rev. 2025;169:105967.
[60] Holdaway AS, Luebbe AM, Becker SP. Rumination in relation to suicide risk, ideation, and attempts: Exacerbation by poor sleep quality? J Affect Disord. 2018;236:6–13.
[61] Zohar D et al. The effects of sleep loss on medical residents' emotional reactions to work events: A cognitive-energy model. Sleep. 2005;28(1):47–54.
[62] Jiménez E et al. Clinical features, impulsivity, temperament and functioning and their role in suicidality in patients with bipolar disorder. Acta Psychiatr Scand. 2016;133(4):266–76.
[63] Konopka RJ, Benzer S. Clock mutants of Drosophila melanogaster. Proc Natl Acad Sci. 1971;68(9):2112–6.
[64] Ozburn AR et al. Functional implications of the CLOCK 3111T/C single-nucleotide polymorphism. Front Psych. 2016;7:67.
[65] Schrader LA et al. Circadian disruption, clock genes, and metabolic health. J Clin Invest. 2024;134(14).
[66] Chung S et al. Impact of circadian nuclear receptor REV-ERBα on midbrain dopamine production and mood regulation. Cell. 2014;157(4):858–68.
[67] Oliveira T et al. Genetic polymorphisms associated with circadian rhythm dysregulation provide new perspectives on bipolar disorder. Bipolar Disord. 2018;20(6):515–22.
[68] Benedetti F et al. Influence of CLOCK gene polymorphism on circadian mood fluctuation and illness recurrence in bipolar depression. Am J Med Genet. 2003;123(1):23–6.
[69] Mcclung CA. Circadian genes, rhythms and the biology of mood disorders. Pharmacol Ther. 2007;114(2):222–32.
[70] Murray G, Harvey A. Circadian rhythms and sleep in bipolar disorder. Bipolar Disord. 2010;12(5):459–72.
[71] Levey DF et al. Towards understanding and predicting suicidality in women: Biomarkers and clinical risk assessment. Mol Psychiatry. 2016;21(6):768–85.
[72] Beyer DKE, Freund N. Animal models for bipolar disorder: From bedside to the cage. International Journal of Bipolar Disorders. 2017;5(1).
[73] Alloy LB, Nusslock R, Boland EM. The development and course of bipolar Spectrum disorders: An integrated reward and circadian rhythm dysregulation model. Annu Rev Clin Psychol. 2015;11:213–50.
[74] Goldschmied JR et al. The relationship between sleep and circadian patterns with risk for suicide in bipolar disorder varies by subtype. J Psychiatr Res. 2025;181:23–8.
[75] Kaplan KA, Williams R. Hypersomnia: An overlooked, but not overestimated, sleep disturbance in bipolar disorder. Evid Based Ment Health. 2017;20(2):59.
[76] Romo-Nava F et al. Evening chronotype as a discrete clinical subphenotype in bipolar disorder. J Affect Disord. 2020;266:556–62.
[77] McClung CA. How might circadian rhythms control mood? Let me count the ways. Biol Psychiatry. 2013;74(4):242–9.
[78] Bernert RA et al. 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 Psychiatry. 2014;71(10):1129–37.
[79] Anmella G et al. Identifying digital biomarkers of illness activity and treatment response in bipolar disorder with a novel wearable device (TIMEBASE): Protocol for a pragmatic observational clinical study. BJPsych Open. 2024;10(5):e143.
[80] Lewitzka U et al. The suicide prevention effect of lithium: More than 20 years of evidence—A narrative review. International Journal of Bipolar Disorders. 2015;3(1):15.
[81] De Crescenzo F et al. Comparative effects of pharmacological interventions for the acute and long-term management of insomnia disorder in adults: A systematic review and network meta-analysis. Lancet. 2022;400(10347):170–84.
[82] Riemann D et al. The European insomnia guideline: An update on the diagnosis and treatment of insomnia 2023. J Sleep Res. 2023;32(6):e14035.
[83] Hertenstein E et al. Cognitive behavioral therapy for insomnia in patients with mental disorders and comorbid insomnia: A systematic review and meta-analysis. Sleep Med Rev. 2022;62:101597.
[84] Harvey AG et al. Treating insomnia improves mood state, sleep, and functioning in bipolar disorder: A pilot randomized controlled trial. J Consult Clin Psychol. 2015;83(3):564–77.
[85] Lipschitz JM et al. Digital phenotyping in bipolar disorder: Using longitudinal Fitbit data and personalized machine learning to predict mood symptomatology. Acta Psychiatr Scand. 2024;149(5):436–48.
[86] McIntyre RS et al. Bipolar disorder and suicide: Research synthesis and clinical translation. Curr Psychiatry Rep. 2008;10(1):66–72.
[87] Sesso G, Brancati GE, Masi G. Comorbidities in youth with bipolar disorder: Clinical features and pharmacological management. Curr Neuropharmacol. 2023;21(4):911–34.

[88] Oliva V et al. Machine learning prediction of comorbid substance use disorders among people with bipolar disorder. J Clin Med. 2022;11(14):3935.
[89] Abad VC, Guilleminault C. Sleep and psychiatry. Dialogues Clin Neurosci. 2005;7(4):291–303.
[90] Ilzarbe L, Vieta E. The elephant in the room: Medication as confounder. Eur Neuropsychopharmacol. 2023;71:6–8.
[91] Radua J et al. Impact of air pollution and climate change on mental health outcomes: An umbrella review of global evidence. World Psychiatry. 2024; 23(2):244–56.
[92] Anmella G et al. Exploring digital biomarkers of illness activity in mood episodes: Hypotheses generating and model development study. JMIR Mhealth Uhealth. 2023;11(1):e45405.
[93] Valenzuela-Pascual C et al. Sleep–wake variations of electrodermal activity in bipolar disorder. Acta Psychiatr Scand. 2025;151(3):412–25.
[94] Oliva V et al. Patterns of antipsychotic prescription and accelerometer-based physical activity levels in people with schizophrenia spectrum disorders: A multicenter, prospective study. Int Clin Psychopharmacol. 2023;38(1):28–39.