Research paper

Racing thoughts revisited: A key dimension of activation in bipolar disorder

Luisa Weiner[a,b,*], Paolo Ossola[c], Jean-Baptiste Causin[a,b], Martin Desseilles[d], Ineke Keizer[e], Jean-Yves Metzger[f], Elena Garcia Krafes[f], Charles Monteil[f], Alexandre Morali[g], Sonia Garcia[g], Carlo Marchesi[c], Anne Giersch[a], Gilles Bertschy[a,b], Sébastien Weibel[a,b]

[a] INSERM U1114, Strasbourg, France
[b] Psychiatry Department, University Hospital of Strasbourg, Strasbourg, France
[c] Department of Medicine and Surgery, Università di Parma, Parma, Italy
[d] University of Namur, Namur, Belgium
[e] University Hospital of Geneva, Geneva, Switzerland
[f] Psychiatry Department, Hôpitaux Civils de Colmar, Colmar, France
[g] Etablissement Public de Santé Alsace Nord, Brumath, France

ARTICLE INFO

ABSTRACT

Background: Racing and crowded thoughts are frequently reported respectively in manic and mixed episodes of bipolar disorder (BD). However, questionnaires assessing this symptom are lacking. Here we aimed investigate racing thoughts across different mood episodes of BD through a self-report questionnaire that we developed, the 34-item Racing and Crowded Thoughts Questionnaire (RCTQ). In addition to assessing its factor structure and validity, we were interested in the RCTQ's ability to discriminate mixed and non-mixed depression.

Methods: 221 BD patients and 120 controls were clinically assessed via the YMRS (mania) and the QIDS-C16 (depression), then fulfilled the RCTQ, rumination, worry, and anxiety measures. Three depression groups were operationalized according to YMRS scores: YMRS scores 2 > 6 and YMRS scores = 1 or 2, for respectively mixed and non-pure depression, and YMRS = 0 for pure-depression.

Results: Confirmatory factor analysis showed that the three-factor model of the RCTQ yielded the best fit indices, which improved after the removal of redundant items, resulting in a 13-item questionnaire. Hypomanic and anxiety symptoms were the main predictors of scores; rumination was not a significant predictor. RCTQ results were similar between mixed groups and non-pure depression, and both were higher than in pure-depression.

Limitations: Patients' pharmacological treatment might have influenced the results.

Conclusions: The 13-item RCTQ captures different facets of racing thoughts heightened in hypomanic and mixed states, but also in depression with subclinical hypomanic/activation symptoms (e.g. non-pure depression characterized by enhanced subjective irritability), suggesting that it is particularly sensitive to activation symptoms in BD, and could become a valuable tool in the follow-up of patients.

1. Introduction

Racing thoughts refer to a subjective acceleration and over-production of thoughts which have been essentially associated with manic/hypomanic episodes in bipolar disorder (BD) (Piguet et al., 2010). Indeed, only in its most recent version has the *Diagnostic and Statistical Manual of Mental Disorders* (DSM) acknowledged racing thoughts as a manic/hypomanic symptom that may also occur during predominantly depressive episodes as part of the 'mixed features' specifier (APA, 2013). According to the DSM-5, the 'mixed features' specifier can be applied when three non-overlapping symptoms of opposite polarity co-occur with major depression or hypomania/mania. Importantly, among non-overlapping symptoms, racing thoughts have been consistently linked to mixed features in depression, with some studies suggesting that they might be a core symptom, present in up to 89% of patients (Akiskal and Benazzi, 2006; Faedda et al., 2015; Miller et al., 2016). The identification of racing thoughts concurrent with depressed mood might thus bear important consequences for care, given that 'mixed features' are associated with increased suicidality (Akiskal and Benazzi, 2006; Benazzi, 2007; Dodd et al., 2010) and poorer response to antidepressant medication (Stahl et al., 2017). Racing thoughts in particular are related to a greater likelihood of

---

conversion to BD in youth presenting with a first depressive episode (Fiedorowicz et al., 2011; Zeschel et al., 2013;'Diler et al., 2017). Here we aimed at investigating the psychometric properties of a self-report questionnaire we have developed, the Racing and Crowded Thoughts Questionnaire (RCTQ), and particularly its ability to discriminate typical from mixed depressive episodes in BD.

Prior studies have shown that clinicians often fail to recognize symptoms from the opposite polarity in predominantly depressive or manic episodes (Goldberg et al., 2000, 2009). This might be due to the specific phenomenology of mixed episodes, including increased anxiety and crowded thoughts (Piguet et al., 2010; Swann, 2017), which has been thus far overlooked by nosological classifications (Sani et al., 2014). Moreover, because symptoms shared by mania and depression (i.e., distractibility, irritability, and psychomotor agitation, or DIP) were excluded from the mixed features specifier, the currently established diagnostic criteria have been found to lack sensitivity, allowing the diagnosis of mixed depression only in one out of four cases (Perugi et al., 2015). Recently, studies have shown that the presence of fewer concurrent symptoms from the opposite polarity, regardless of their overlapping nature – e.g., a score above 2 on the Young Mania Rating Scale (Young et al., 1978), had better sensitivity and specificity than the current DSM-5 diagnostic criteria for depression 'with mixed features' (e.g., Perugi et al., 2015; Miller et al., 2016). Sani et al. (2014) have recently proposed and validated other criteria focusing on psychic activation symptoms in depression, arguing that the DSM criteria failed to acknowledge the defining symptoms of mixed depression (i.e., irritability, inner tension and psychomotor agitation). In one study, the presence of only one manic symptom in depressive episodes was associated with an increase from 17 to 61% of the prevalence of symptoms with mixed-suggestive phenomenology, i.e., irritability, aggressiveness and inner tension (Bertschy et al., 2008). The authors hypothesized that racing thoughts, which was not assessed in their study, subtended irritability, aggressiveness and inner tension in patients with mixed depression.

Two types of racing thoughts have been identified in phenomenological studies in patients with mood disorders – i.e., 'racing' and 'crowded', associated with manic and depressed mood, respectively (Piguet et al., 2010). The phenomenology of racing and crowded thoughts seem to differ: racing thoughts are characterized by a rapid overflow of thoughts, usually associated with elated mood, whereas crowded thoughts are described as "overcrowded" in the patient's head and are associated with functional impairment (Benazzi, 2007; Piguet et al., 2010; Desseilles et al., 2012). Interestingly, crowded thoughts may be found in association with predominantly depressive, but also mixed (hypo)manic episodes (Benazzi, 2007); in the latter cases, thinking has been described as "fragmented", "congested", and associated with an unpleasant feeling of lack of control, akin to crowded thoughts (Goodwin and Jamison, 2007; Hersh, 2010).

A critical issue is to delineate crowded thoughts relative to other thinking styles associated with an unpleasant mood, i.e., rumination and worry. Rumination has been defined as a repetitive, and analytical pattern of thinking typically associated with depressive mood (Aldao et al., 2010). Unlike crowded thoughts rumination is thus repetitive in nature, and it is characterized by poverty of thought (Desseilles et al., 2012; Marchetti et al., 2014). Moreover, it is not associated with elated mood nor manic symptoms (Van der Gucht et al., 2009; Weiner et al., 2018); hence, it should not distinguish mixed and non-mixed depressive episodes. Worry is similar to rumination inasmuch as it is repetitive; however, it differs from rumination due to its association with hyperarousal (Lewis et al., 2017). Like rumination, worry has been under-researched in BD, but one study found it to be increased during mixed episodes compared to pure manic episodes (Dilsaver et al., 1999).

Based on Koukopoulos et al. (2007) diagnostic criteria for mixed depression, Sani et al. (2018) have recently developed a 14-item clinician rating scale that assesses psychomotor excitation symptoms,

including racing and crowded thoughts, in mixed depression. However, in their scale, only one item assessed racing and crowded thoughts, and rumination was also considered in the scoring of the item.

To our knowledge, there is only one questionnaire, the 9-item Subjective Thought Overactivation Questionnaire (STOQ; Keizer et al., 2014), designed to specifically assess racing and crowded thoughts in patients with mood disorder. The initial STOQ contained items that were developed by two of the authors (GB and IK). However, its discriminant power was modest, as scores were equivalent in the manic and depression groups, and they did not allow the distinction between mania and euthymia. Moreover, the single-factor STOQ-9 did not address the numerous features found in the qualitative analysis of patient reports (Keizer et al., 2014). Hence to address the multi-faceted nature of racing and crowded thoughts in different episodes of mood disorders, we developed a new questionnaire, the 34-item RCTQ (Weiner et al., 2018).

In a recent study in healthy individuals, the RCTQ was found to have good convergent and divergent validity, as results were highly correlated with cyclothymic temperament traits, on the one hand, and unrelated to rumination scores, on the other hand. Principal component analysis yielded a three-factor solution – i.e., 'thought overactivation', 'burden of thought overactivation', and 'thought overexcitability' (Weiner et al., 2018). Some items were highly intercorrelated, suggesting that the scale could be shortened to facilitate its ease of use in clinical settings.

The aim of the present study is to evaluate the factor structure, validity and reliability of the RCTQ, in patients with BD and healthy controls. If the RCTQ captures thought overactivation specifically associated with manic mood, then RCTQ scores should be higher in manic and mixed episodes compared to depressive and euthymic episodes. We were particularly interested in the RCTQ's ability to discriminate mixed and non-mixed depression. Given that mixed symptoms in depression might be observed with very few concurrent hypomanic symptoms (Bertschy et al., 2008; Miller et al., 2016), we investigated RCTQ scores in mixed depression groups using two different thresholds of hypomanic symptoms– i.e., YMRS scores above 2 (Miller et al., 2016), and YMRS scores of 1 or 2 (Bertschy et al., 2008). Moreover, racing thoughts, measured via the RCTQ, were expected to be distinct and independent from rumination, but related to anxiety and worry characteristic of mixed states (Swann, 2017).

2. Participants and methods

2.1. Participants

Two hundred and twenty-one patients aged 18–64 ($M = 44.69$, SD = 0.83) with BD and 120 healthy individuals aged 18–64 ($M = 33.59$, SD = 1.13) were recruited in the inpatient and outpatient clinics of the Alsace region in France, the University Hospital of Parma in Italy, and the Psychiatric Clinic of Henri-Chapelle in Belgium. Patients fulfilled criteria for BD according to the DSM-IV-TR (APA, 2000). Healthy volunteers were recruited by advertisement. Subjects provided written informed consent prior to their inclusion. Detailed demographic data from French-speaking ($n = 180$), and Italian-speaking ($n = 161$) subjects are presented in Table 1. See supplementary material for further details. This study was approved by the regional ethics committee of the East of France and of Parma.

2.2. Materials and procedures

Patients were considered to be in a predominantly depressive or manic/(hypo)manic episode if they fulfilled the DSM-IV-TR criteria for either episode (APA, 2000). Mania and depression symptoms were assessed with the YMRS (Young et al., 1978) and the Quick Inventory of Depressive Symptomatology–Clinician-Rated Version (QIDS-C16; Rush et al., 2003). A YMRS score >5 was reflective of hypomania or

Table 1
Demographic characteristics of the patient and control samples.

	Hypomania $n = 53$	Mixed hypomania $n = 24$	Mixed Depression $n = 29$	Non-pure depression $n = 30$	Pure depression $n = 36$	Euthymia $n = 46$	Controls $n = 120$	p
Age[a]	41.11 (13.15)	44.71 (11.37)	44.38 (13.14)	42.9 (11.89)	47.74 (14.20)	45.89 (10.29)	33.66 (10.29)	<.01
Sex (F/M)	29/24	14/10	24/5	23/7	19/17	20/26	80/40	<.01
Years of education[a]	13.5 (13.29)	12.75 (3.36)	13.93 (3.13)	12.84 (3.03)	14.27 (3.46)	13.61 (3.19)	15.46 (3.01)	<.01
Illness duration (months)[a]	158.57 (130.56)	144.75 (139.04)	188.19 (151.86)	191.48 (210.76)	107.79 (97.82)	198.87 (155.10)	–	.15
YMRS[a]	14.60 (6.52)	13.46 (7.71)	3.83 (0.97)	1.58 (0.50)	0 (0)	0.86 (1.49)	0.74 (1.24)	<.001
QIDS-C16[a]	2.36 (1.82)	9.50 (2.88)	13.12 (3.36)	13.12 (4.47)	12.03 (3.29)	1.45 (1.57)	0.87 (1.20)	<.001
Lithium (% yes)	31%	25%	38%	13%	24%	43%	–	
Anti-epileptics (% yes)	43%	54%	35%	35%	30%	61%	–	
Antipsychotics (%yes)	40%	54%	24%	25%	16%	41%	–	
Antidepressants (%yes)	9%	29%	41%	44%	46%	33%	–	

YMRS = Young Mania Rating Scale; QIDS-C16 = Quick Inventory of Depressive Symptomatology.

[a] Mean and standard deviation.

mania (Favre et al., 2003) and a QIDS-C16 score >5 was reflective of depression (Rush et al., 2003). No upper limit was set for the severity of manic symptoms; patients were included if their clinical state was compatible with their participation in our study and the maximal score was 37. Mixed hypomania was operationalized as manic and depressive symptoms that were above their respective cut-offs (Suppes et al., 2005). Mixed depression was operationalized as above threshold depressive symptoms (QIDS-C16 score >5), co-occurring with mild hypomanic symptoms (YMRS score >2 and <6; YMRS score cut-off of at least 2 was proposed by Miller et al. (2016) to distinguish pure and mixed depression). When subjects had a QIDS-C16 score >5, and a YMRS score of 1 or 2 (13 patients had a YMRS score of 1, i.e., 43%), they were considered to be in a depressive episode with mild hypomanic symptoms, i.e., non-pure depression (Bertschy et al., 2008). Only subjects who had a YMRS score of zero were labelled as presenting a pure depressive episode. Euthymia was defined as below the threshold scores in the YMRS and the QIDS-C16. In addition to the RCTQ, participants in French-speaking sites only were also administered self-rated questionnaires assessing anxiety, worry, and rumination.

2.2.1. Racing and Crowded Thoughts Questionnaire (RCTQ)

The RCTQ is a 34-item self-report questionnaire that assesses racing thoughts during the past 24 h. Nine items of the RCTQ belong to the Subjective Thought Overactivation Questionnaire (STOQ; Keizer et al., 2014), of which 4 underwent very minor wording adaptations, whereas the remaining 25 items were developed by three experienced clinicians (GB, IK and LW) based on the six themes that emerged in the qualitative reports of patients (Keizer et al., 2014). Initially 17 items were conceived to refer to racing thoughts; they convey the notion of an acceleration and an increased amount of thoughts that are linked to each other in a sequential manner (e.g., my thoughts race at 200 km/h); these thoughts are usually associated with positive emotions and are not perceived as being emotionally overwhelming. The remaining 17 items referring to crowded thoughts are related to an increased amount of thoughts that are linked to each other in a simultaneous manner, as if thoughts were accumulating in one's mind (e.g., thoughts accumulate in my head); these thoughts are usually associated with an increased information processing load, and the feeling of being emotionally overwhelmed. Both racing and crowded thoughts items portray thoughts as arising in one's mind involuntarily (e.g., my thoughts take off on their own). Items are rated on a scale from 0 ("not at all") to 4 ("completely agree"). RCTQ items were conceived in French and were translated into Italian and back-translated into French. Likewise, the English version of the RCTQ items was translated and back-translated by professional translators.

2.2.2. Other measures

The Ruminative Response Scale State version (RRS-S; Treynor et al., 2003) is a 22-item self-report questionnaire which evaluates two

aspects of rumination during the past 7 days: 'Brooding' and 'reflection' which are respectively maladaptive and adaptive. Items are rated on a scale from 1 to 4.

The Penn State Worry Questionnaire-state version (PSWQ; Stöber and Bittencourt, 1998) is a 15-item scale, rated on a scale from 0 to 6, which measures the level of worry during the previous week.

The Beck Anxiety Inventory (BAI; Beck et al., 1988) is a 21-item self-report questionnaire, rated on a scale ranging from 0 to 3, that measures symptoms of anxiety during the past 7 days.

2.3. Statistical analyses

In order to investigate the goodness of fit of the three a priori models relative to the factor structure of the RCTQ, we used Confirmatory Factor Analysis (CFA). CFA assists in the reduction of measurement error and allows the comparison of a priori models at the latent factor level (Jackson et al., 2009; Atkinson et al., 2011). In the present study, there were three a priori models regarding the construct validity of the RCTQ: (i) the single-factor model yielded by the STOQ-9 results (Keizer et al., 2014), (ii) the bifactorial model, referring to the racing vs. crowded thoughts theoretical distinction (Piguet et al., 2010), and (iii) the three-factor model, based on the results obtained in healthy individuals (Weiner et al., 2018). For the single-factor model, the 34 items of the RCTQ were included in the analysis (model 1); for the bifactorial model (model 2), 17 items belonging to the 'racing' a priori factor, i.e., items 2, 5, 7, 8, 11, 12, 14, 17, 20, 21, 22, 25, 28, 30, 31, 32 & 34, and 17 items belonging to the 'crowded' a priori factor, i.e., items 1, 3, 4, 6, 9, 10, 13, 15, 16, 18, 19, 23, 24, 26, 27, 29, 33, were included; for the three-factor model (model 3), factor 1 consisted of items 1, 2, 4, 5, 7, 8 & 9, factor 2 consisted of items 10, 13, 14, 15, 18, 23, 29 & 30, and factor 3 consisted of items 12, 17, 20, 21, 22, 25, 31 & 32 (Weiner et al., 2018). In all cases maximum likelihood estimation was employed, excluding cases with missing values.

The following fit indices were analyzed based on guidelines for CFA reporting (Jackson et al., 2009): the chi-square, the comparative fit index (CFI; Bentler, 1990), the Tucker–Lewis Index (TLI; Tucker and Lewis, 1973), the root-mean-square error of approximation (RMSEA) and the standardized root mean square residual (SRMR). Cut-offs were based on Hu and Bentler (1999): RMSEA values were considered good when they were less than 0.06. CFI and the SMSR values were expected to be greater than 0.90 and less or equal to 0.08, respectively. The TLI should range between 0 and 1, with a value of at least 0.95 indicating a good fit model. When comparing models, a lower chi-square value indicates a better fit, given an equal number of degrees of freedom (Schreiber et al., 2006). Following the removal of highly intercorrelated ($r > 0.75$), hence redundant items, and/or items with short dispersion values (SD ≤ 1.30), i.e., less discriminant items, we assessed again the goodness of fit of the retained model.

Internal consistency of each identified factor was assessed with the

Cronbach's alpha coefficient (Cronbach, 1951). A coefficient of at least 0.7 was expected.

Because of the non-parametric distribution of data, the Kruskal–Wallis test was used for comparing RCTQ ordinal scores between groups. Post-hoc comparisons were performed using the false discovery rate (FDR) method (Benjamini and Hochberg, 1995) of alpha level adjustment for multiple comparisons. Statistical significance was set at 0.05 (two-sided tests). Convergent validity was assessed by correlating scores on the item 7 of the YMRS, which is a clinician-rated assessment of racing thoughts, and RCTQ scores in patients. Multiple regression analyses of the log-transformed questionnaire measures were performed, controlling for age, sex and education, in order to partial out the effects of the different clinical dimensions on the RCTQ scores in the subset of French-speaking subjects. Statistical significance was set at 0.05. Analyses were performed using the Stata 14.1 and Statistica softwares.

3. Results

3.1. Descriptive analyses

Total RCTQ scores were distributed between 0 and 135, with a median value at 19. Mean scores, floor and ceiling percentage values for each of the 34 items of the RCTQ are presented in Table 2.

3.2. CFA and scale reduction

The single-factor and the bifactorial models of the RCTQ did not yield a good fit since the CFI values (0.88 and 0.89, respectively) and the TLI values (0.88, and 0.88, respectively) were low. The three-factor model had better fit statistics (CFI = 0.93; TLI = 0.92; χ^2 = 895.009),

i.e., higher CFI and TLI and lower χ^2 values compared to the single and the bifactorial models (Table 3). SRMR results were acceptable in the three models. Although the three-factor model had the best fit, TLI and RMSEA values were fair and mediocre, respectively.

Following the removal of redundant and/or less discriminant items of the three-factor scale, four items were retained in factor 1 (thought overactivation) – i.e., items 1, 2, 5 and 8 –, and factor 2 (burden of thought overactivation) – i.e., items 13, 14, 15 and 23. Five items were of part of factor 3 (thought overexcitability), i.e., 12, 22, 25, 31, and 32. Median values for factor 1, 2, and 3 were respectively 3, 1, and 3. With the short-version of the three-factor RCTQ, we improved the fit statistics of the model (CFI = 0.96; TLI = 0.96; χ^2 = 224.859) considerably, and RMSEA values were fair. CFA fit index values are presented in table 3.

3.3. Reliability

Alpha coefficients were equally high for the short (0.92, 0.95 and 0.92, for factors 1, 2 and 3 respectively) and the long three subscales (0.95, 0.97 and 0.95, for factors 1, 2 and 3 respectively) of the RCTQ, suggesting excellent internal consistency.

3.4. Discriminant validity

Scores differed significantly between groups for the 'thought overactivation' subscale ($p < .001$, Kruskal–Wallis test), the 'burden of thought overactivation' subscale ($p < .001$, Kruskal–Wallis test), and the 'thought overexcitability' subscale of the 13-item RCTQ ($p < .001$, Kruskal–Wallis test; Fig. 1). For the sake of simplicity, aside from the results presented subsequently, other comparisons were not significant, and will not be detailed. Post-hoc analyses revealed that scores were

Table 2
Distribution of scores on the 34 items of the RCTQ.

RCTQ item	RCTQ question	Mean (SD)	% floor	% ceiling
1	I have too many thoughts at the same time.	1.41 (1.45)	40.53	14.2
2	My thoughts race at 200 km/h	1.12 (1.44)	52.37	12.72
3	My thoughts get twisted and mixed up.	1.02 (1.37)	55.33	9.76
4	Thoughts accumulate in my head.	1.35 (1.42)	40.53	12.43
5	My thoughts keep changing topics.	1.11 (1.41)	52.66	11.24
6	When I speak, I feel less distressed by the stream of thoughts in my mind.	1.31 (1.44)	45.56	11.83
7	My thoughts take off on their own.	0.96 (1.34)	58.58	7.99
8	There is a succession of thoughts in my mind, racing from one to the other with incredible ease.	1.21 (1.42)	48.52	11.83
9	Many thoughts come up and cross my mind at the same time.	1.20 (1.39)	46.45	10.95
10	The intensity of my mental activity is unbearable.	0.78 (1.25)	65.68	6.51
11	My mind 'jumps ' from one thought to another ceaselessly.	1.12 (1.34)	48.82	9.17
12	Each object, each detail surrounding me gives rise to a new thought.	1.09 (1.32)	47.63	9.47
13	My brain cannot manage all these thoughts that arise at the same time.	0.87 (1.32)	62.43	7.99
14	I feel distressed in my everyday life by the great number of thoughts or by the velocity of the thoughts in my mind.	0.96 (1.38)	59.17	9.76
15	I cannot seem to stop the mechanism that generates all of these thoughts in my head.	1.15 (1.50)	56.8	12.43
16	At any given moment, a great number of thoughts come and go in my head.	1.09 (1.42)	53.55	11.54
17	My thoughts race when my attention is not captured by an activity	1.19 (1.41)	48.52	11.54
18	My thoughts overflow: it is like an overload.	0.89 (1.37)	63.02	10.06
19	My brain moves faster than my body.	1.28 (1.44)	45.27	12.72
20	At any given moment, new thoughts burst from nowhere in my mind.	0.79 (1.21)	61.24	5.92
21	Everything I hear or see immediately gives rise to a new thought.	1.01 (1.26)	50	7.1
22	There is not enough time to grasp the meaning of a thought, as new ones immediately arise.	0.86 (1.30)	60.95	8.28
23	Keeping focused in the middle of this thought overload is a constant struggle.	1.00 (1.41)	57.4	11.24
24	Thoughts pile up in my head.	1.00 (1.34)	53.85	9.76
25	A thought immediately leads to another, which leads to another, then another…	1.04 (1.37)	52.66	10.65
26	My thoughts fly in all directions.	0.95 (1.31)	56.21	8.28
27	I find it difficult to express myself because of the amount or the speed of my thoughts.	0.69 (1.20)	67.75	6.51
28	My thoughts race much too fast.	1.04 (1.36)	53.25	9.76
29	My mental overactivity is exhausting.	0.97 (1.40)	60.36	10.95
30	I cannot slow down or reduce the stream of thoughts in my head.	0.99 (1.35)	56.51	8.58
31	My thoughts often take me very far away from my initial idea.	1.02 (1.28)	51.18	7.69
32	When my thoughts race, I disconnect from everything around me.	1.11 (1.36)	53.85	10.95
33	My thoughts bump into each other in my head	1.02 (1.36)	53.85	10.06
34	There is a permanent parade of thoughts in my mind: one after the other, ceaselessly.	0.91 (1.36)	61.54	8.88

SD = standard deviation; RCTQ = Racing and Crowded thoughts Questionnaire.

Table 3
Comparison of CFA fit indices in three models.

	RMSEA	90% CI		TLI	CFI	SRMR	χ^2
Model 1 (one factor)	0.099	0.094	0.103	0.876	0.884	0.034	1239.551
Model 2 (two factors)	0.098	0.094	0.102	0.878	0.886	0.034	2259.883
Model 3 (three factors)	0.093	0.087	0.100	0.921	0.930	0.033	895.009
Model 3 (short version)	0.088	0.076	0.101	0.956	0.965	0.026	224.859

RMSEA = Root Mean Squared Error of Approximation; CI = confidence interval; TLI = Tucker Lewis Index; CFI = Comparative Fit Index; SRMR = Standard Root Mean Square Residual.

higher in the acute groups compared to euthymic ($p < .01$) and control groups ($p < .01$) on the three subscales. When comparing the hypomanic and the pure depression group, hypomanic scores were higher on the 'thought overactivation' subscale ($p < .05$); tended to be higher on the 'thought overexcitability' subscale ($p = .09$); and were similar between the two groups on the 'burden of thought overactivation' subscale ($p = .71$). Patients in mixed episodes had, on average, the highest scores. Compared to pure depression, mixed hypomanic patients had higher RCTQ scores on the 'thought overactivation' and 'thought overexcitability' subscales ($p = .035$ and $p = .045$, respectively), and scores tended to be higher on the burden of thought overactivation subscale ($p = .07$). Compared to pure depression, mixed depression patients had higher scores on the 'thought overactivation', and 'burden of thought overactivation' subscales ($p = .02$ and $p = .045$, respectively), while scores tended to be higher on the 'thought overexcitability' subscale ($p = .058$). Scores were significantly higher in the non-pure depression (YMRS = 1 or 2) relative to the pure depression group (YMRS = 0) on the three subscales ($p = .02$, $p = .048$, $p = .035$, for factors 1, 2, 3, respectively). RCTQ results did not differ between the mixed depression and the non-pure depression group. Relative to the control group, euthymic patients had similar scores on the 'thought overactivation' and 'thought overexcitability' subscales ($p = .74$ and $p = .55$, respectively), but results were increased on the 'burden of thought overactivation' subscale ($p = .03$).

3.5. Convergent validity

'Thought overactivation', 'burden of thought overactivation', and 'thought overexcitability' scores were significantly correlated to the YMRS item 7 score, a clinician-rated measure of racing thoughts – i.e., $\rho = 0.35$, $p < .001$, $\rho = 0.22$, $p < .05$, and $\rho = 0.35$, $p < .001$, respectively.

3.6. Multiple regression analyses

To investigate the relationship between clinical dimensions and scores on the three-factor short RCTQ, we conducted multiple regression analyses on the logarithmic transformed RCTQ results from the French-speaking patient sample. Six predictors – i.e., the YMRS, the QIDS-C16, the two RRS subscales, the BAI, and the PSWQ scores –, were simultaneously entered into the model. Regarding socio-demographic variables, age, sex, and education had no significant effect on 'thought overactivation' and 'burden of thought overactivation' scores; although age was positively correlated and years of education were negatively correlated with 'thought overexcitability' scores ($p = 0.01$ and $p < .001$, respectively), results presented below remained unchanged when controlling for these variables. Regarding 'thought overactivation', predictors accounted for 35% of the variance, with significant contributions from (i) YMRS score ($\beta = 0.38$, $p < .001$), and (ii) BAI score ($\beta = 0.30$, $p < .01$). For 'burden of thought overactivation', the predictors accounted for 42% of the variance, with significant effects of (i) BAI score ($\beta = 0.36$, $p < .001$) and (ii) PSWQ score ($\beta = 0.28$, $p = .01$). Regarding 'thought overexcitability', the predictors accounted for 40% of the variance, with significant contributions from (i) YMRS score ($\beta = 0.32$, $p < .001$), (ii) BAI score ($\beta = 0.27$, $p = .01$), and (iii) PSWQ score ($\beta = 0.33$, $p \leq .01$; Table 4).

4. Discussion

Compared to the single and the two-factor models, the three-factor solution of the RCTQ yielded the best fit indices in patients with BD, consistent with our results in healthy individuals (Weiner et al., 2018). This was particularly the case of the short 13-item RCTQ, resulting from the removal of redundant and less discriminant items within the three factors. Moreover, the evaluation of the psychometric properties of the scale suggests that the RCTQ is both valid and reliable when used in patients with mood disorders. Indeed, the internal consistency of each
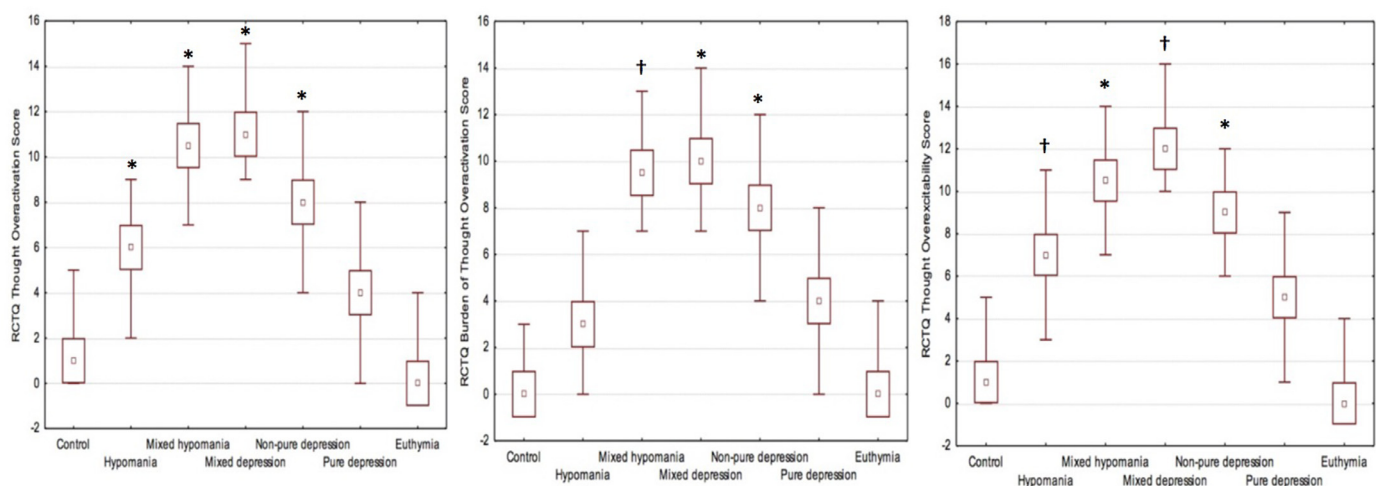

Fig. 1. RCTQ subscale scores (median and range) between groups; *$p < .05$ and †$p < .10$ compared to pure depression.

Table 4
RCTQ subscale scores as a function of other instruments (multiple linear regression) in patients ($n = 130$).

Instrument	RCTQ thought overactivation[a]			RCTQ burden of thought overactivation[b]			RCTQ thought overexcitability[c]		
	β	t	p	β	t	p	β	t	p
YMRS	0.38	4.45	**<.001**	0.12	1.51	.13	0.32	3.80	**<.001**
QIDS-C16	0.07	0.62	.54	0.02	.17	.86	−0.04	−0.39	.69
BAI	0.30	3.15	**<.01**	0.36	3.92	**<.001**	0.27	2.91	**<.01**
PSWQ	0.17	1.61	.11	0.28	2.90	**<.01**	0.33	3.30	**<.01**
RRS-brooding	0.01	0.14	.89	0.16	1.43	.15	0.09	0.79	.43
RRS-reflection	0.06	0.59	.55	−0.06	−0.65	.51	0.004	0.038	.97

RCTQ = Crowded Racing Thoughts Questionnaire; RRS = Rumination Response Scale; YMRS = Young Mania Rating Scale; QIDS-C16 = Quick Inventory of Depressive Symptomatology; BAI = Beck Anxiety Inventory; PSWQ = Penn State Worry Questionnaire.
[a] $R^2 = 0.38$ adjusted $R^2 = 0.35$, $F(6,123) = 12.50$, $p < .001$.
[b] $R^2 = 0.45$ adjusted $R^2 = 0.42$ $F(6,123) = 22.23$, $p < .001$.
[c] $R^2 = 0.43$, adjusted $R^2 = 0.40$, $F(6,123) = 15.16$, $p < .001$.
Significant results are presented in bold ($p < .05$).

of the three subscales of the RCTQ is excellent, and the scale has good discriminant validity, as scores in the four groups presenting with manic symptoms were overall higher than those obtained in typical depression, euthymia, and healthy states. Importantly, relative to pure depression, results in the three subscales were overall higher in the two depression groups presenting with subthreshold hypomanic symptoms – i.e., 'mixed depression', and 'non-pure depression' –, suggesting that very mild hypomanic symptoms may be associated with racing thoughts during depressive episodes. Anxiety, hypomania, and worry symptoms may be involved in these results, as they were the main predictors of RCTQ scores. Consistent with our results in healthy individuals (Weiner et al., 2018), rumination was unrelated to racing thoughts, indicating that the scale has good divergent validity. That is, the scale measures a construct specifically associated with arousal and hypomanic symptoms, and distinct from rumination. Moreover, clinician-rated racing thoughts, as assessed by the item 7 of the YMRS, were significantly correlated to the three dimensions of the RCTQ, indicating good convergent validity.

Instead of the two theoretical dimensions – i.e., racing and crowded – put forward by recent phenomenological models (Piguet et al., 2010; Desseilles et al., 2012), our results suggest that the racing thoughts phenomena encompass three psychopathological dimensions, similar to the factor structure found in healthy individuals (Weiner et al., 2018), and selectively associated with hypomanic, hyperarousal, and/or worry symptoms.

The first factor, "thought overactivation", seems to be related to what Keizer et al. (2014) labeled as 'pressure of thoughts' in their qualitative study, and refers to the increased amount and velocity of thoughts (e.g., item 2: "My thoughts race at 200 km/h") characteristic of racing thoughts found in pure hypomanic states. Akin to our results in healthy individuals (Weiner et al., 2018), we found that "thought overactivation" is particularly linked to elated mood in patients with mood disorder. Indeed, results in this factor only were undisputedly higher in the hypomanic and mixed depression groups relative to the pure depression group. In addition, hypomanic along with hyperarousal symptoms, as measured by the BAI, were predictors of 'though overactivation' scores. This particular dimension of racing thoughts, referring to a sense of speed and fluidity, seems thus to be experienced not only as elating and productive (Desseilles et al., 2012), but also as arousing.

The second factor, "burden of thought overactivation", seems to correspond to 'crowded thoughts' (Piguet et al., 2010) inasmuch as items loading in this factor refer to an increased amount of thoughts leading to an overwhelming feeling of lack of control (e.g., item 13: "My brain cannot manage all these thoughts that arise at the same time") and functional impairment (e.g., item 23: "Keeping focused in the middle of this thought overload is a constant struggle"). Interestingly, 'burden of thought overactivation' scores were similar in pure

depression and hypomania, whereas they were generally increased in the three mixed groups – i.e., mixed hypomania, mixed depression, non-pure depression – compared to pure depression. This facet of racing thoughts is thus particularly increased in mixed hypomanic and depressive states, but not in pure hypomanic relative to depressive states. Consistently, scores in this subscale were unrelated to hypomanic mood, but were correlated to hyperarousal and worry symptoms, which have been found to be particularly enhanced during mixed episodes (Swann, 2017). These results thus support those from earlier reports by Kraepelin (1899/2008), Braden and Ho (1981) and Benazzi (2007) which had pointed to the fact that racing thoughts found in mixed episodes were more distressing, disjointed and accompanied by functional impairment than those found in pure hypomanic states.

The 'burden of thought overactivation' may not be a selective marker of mixed states, though. Scores were higher in acute groups compared to euthymia, but also in euthymic patients compared to healthy controls. This factor could thus represent a trait-marker of the illness, as suggested by Braden and Ho (1981). Consistent with this assumption, Ferrari et al. (2016) recently reported in a pilot study that STOQ scores, but not brooding rumination, were higher in euthymic patients compared to controls. Our results add to those by further allowing the delineation of the specific dimensions of racing thoughts that might be equally found in depression and hypomania, on the one hand, and increased in euthymic states relative to healthy functioning, on the other hand.

The third factor, "thought overexcitability", includes items that refer to the involuntary onset and distractible nature of racing thoughts, a feature that was highlighted in two of the six themes – i.e., 'information processing' and 'onset and context' – found in the qualitative reports of patients in the study by Keizer et al. (2014). Although it was dismissed by recent phenomenological models (Piguet et al., 2010; Desseilles et al., 2012), distractibility seems to be an important dimension associated with the racing thoughts phenomena, found in healthy individuals (Weiner et al., 2018), and outlined by early descriptive (Kraepelin, 1899/2008) and empirical accounts in patients with BD (Braden and Ho, 1981; Benazzi, 2009). In our study, 'thought overexcitability' scores were associated with hypomanic symptoms, consistent with our previous results in healthy individuals (Weiner et al., 2018), and tended to be higher in hypomanic patients relative to the pure depression group. It is possible that distractibility may be an underlying mechanism fueling racing thoughts, but an inverse causal relationship is also plausible. Another possibility is that distractibility and racing thoughts are intrinsically associated, as part of activation symptoms that could be subtended by the same neural mechanisms. Age and years of education were positively and negatively correlated to scores on this factor only; since attention control declines with age (Lufi et al., 2015), and increases with schooling (Le Carret et al., 2003), we speculate that attention mechanisms may be involved

in this particular dimension. In addition to hypomanic symptoms, higher worry and anxiety scores were also associated with higher 'thought overexcitability' scores, suggesting that this dimension of racing thoughts might be experienced also as both arousing and distressing.

Anxiety symptoms, as measured by the BAI, were the single shared predictor of scores among the three RCTQ subscales. Hence, anxiety seems to be particularly involved in the racing thoughts phenomena, regardless of their subtypes and the predominant mood experienced by the patient. The BAI is a measure of autonomic arousal symptoms, which can be experienced first and foremost in panic disorder (Leyfer et al., 2006). Several studies have suggested that hyperarousal might be a trait of BD, subtended by amygdala dysfunction (MacKinnon, 2008), and particularly heightened during mixed states (Swann, 2017), consistent with our results. Using the STOQ, Keizer et al. (2014) had already reported that increased racing thoughts were correlated to higher state-anxiety scores and diminished well-being. Considered individually however, anxiety cannot explain the distinction between different types of racing thoughts. Indeed, RCTQ 'thought overactivation' results differed significantly between hypomania and depression, whereas BAI scores were similar in these groups. Moreover, in addition to anxiety, other psychopathological dimensions, i.e., hypomania and worry, were also selectively involved in the three RCTQ subscores. Given this, we can argue that, irrespective of its subtype, racing thoughts is an arousing and activating symptom, but, according to its subtype, racing thoughts might be either more elating (i.e., thought overactivation), distressing (i.e., burden of thought overactivation), and/or elating and distressing (i.e., thought overexcitability).

A major finding of our study is that few subthreshold manic symptoms in depressive episodes (for instance, enhanced subjective irritability, resulting in a YMRS score of 1) can yield a significant increase in the three RCTQ subscores. This result suggests that minor (overlapping or not) hypomanic symptoms concurrent with depression may give rise to clinical pictures characteristic of mixed depression (Bertschy et al., 2008). Our results thus add to those from other studies which have argued that, especially when applied to depressive episodes, the DSM-5 criteria for the 'mixed features' specifier might be considered as either too restrictive (e.g., Perugi et al., 2015; Miller et al., 2016; Sani et al., 2018), as it fails to detect a vast majority of patients with mixed depression, or plain wrong given its insistence on leaving out of its definition the core features of mixed depression (i.e., inner tension, irritability and marked psychomotor agitation) (Koukopoulos et al., 2013; Sani et al., 2018). Consistently, based on Koukopoulos et al. (2007) construct for mixed depression, Sani et al. (2018) recently found that the 14-item Koukopoulos Mixed Depression Rating Scale (KMDRS) was valid for assessing activation symptoms in depression. However, only one item assessed racing and crowded thoughts, and rumination was also considered in the scoring of the item. The RCTQ focuses solely on racing and crowded thoughts. Importantly, the RCTQ is particularly sensitive to this core 'activation' symptom, as it captures thinking abnormalities distinct from rumination that are subclinical, i.e., observed in the presence of few subthreshold manic symptoms, in healthy states (Weiner et al., 2018), and in depression.

In clinical settings, the use of the short-version of the RCTQ is warranted. Indeed, we found that the 13-item short version of the RCTQ, obtained through the removal of redundant and less discriminant items, yielded a good fit model, was reliable, and had good discriminant, convergent and divergent validity. Hence, the 13-item RCTQ could become a valuable tool to screen for racing thoughts, i.e. a particularly relevant mixed-suggestive feature in depression. This is of great importance since mixed depression remains largely underdiagnosed in clinical settings (Goldberg et al., 2009; Perugi et al., 2015), and requires specific treatment options (e.g., Stahl et al., 2017). Recently, Vandevoorde et al. (2018) reported, using visual analog

scales, that 'flow of thoughts' was increased in depressed and suicidal inpatients, and subsequently decreased during follow-up. However, co-occurring hypomanic symptoms were not assessed in their sample. To our knowledge, psychometric tools specifically designed to assess the peculiar phenomenology of hypomanic symptoms co-occurring with depression are rare (Swann, 2017; Sani et al., 2018). Given its heightened sensitivity concerning this non-overlapping activation symptom, the RCTQ is a quickly administered self-report tool that could be useful to monitor the emergence of different facets of racing thoughts in the follow-up of patients with depression.

Finally, we acknowledge a few limitations. First, most patients were taking psychotropic drugs that might have influenced the clinical expression of the symptoms. However, given that we found similar results in healthy individuals (Weiner et al., 2018), it is unlikely that medication fully accounted for the results. Second, longitudinal studies are needed to assess the test-retest reliability of the instrument. Third, patients with severe mania could not be included, thus our patient sample might not be fully representative.

The RCTQ is a new instrument that is valid for measuring different facets of racing thoughts in BD. Racing thoughts, as measured by the RCTQ, is distinct from rumination, and is heightened in acute hypomanic and mixed states, but also in depression with very few subthreshold hypomanic features, suggesting that the 13-item RCTQ could be a valuable clinical tool used in the follow-up of patients with mood disorders.

Conflict of interest

Funding

CRediT authorship contribution statement

Luisa Weiner: Writing - original draft, Methodology, Data curation. **Paolo Ossola:** Writing - review & editing, Methodology, Data curation. **Jean-Baptiste Causin:** Methodology. **Martin Desseilles:** Writing - review & editing, Methodology. **Ineke Keizer:** . **Jean-Yves Metzger:** Methodology. **Elena Garcia Krafes:** Methodology. **Charles Monteil:** Methodology. **Alexandre Morali:** Methodology. **Sonia Garcia:** Methodology. **Carlo Marchesi:** Writing - review & editing, Methodology. **Anne Giersch:** Writing - review & editing. **Gilles Bertschy:** Writing - review & editing. **Sébastien Weibel:** Writing - review & editing, Data curation.

Acknowledgments

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.jad.2019.05.033.

References

Akiskal, H.S., Benazzi, F., 2006. Does the FDA proposed list of possible correlates of suicidality associated with antidepressants apply to an adult private practice population? J. Affect. Disord 94, 105–110. https://doi.org/10.1016/j.jad.2006.04.002.

Aldao, A., Nolen-Hoeksema, S., Schweizer, S., 2010. Emotion-regulation strategies across psychopathology: a meta-analytic review. Clin. Psychol. Rev. 30, 217–237. https://doi.org/10.1016/j.cpr.2009.11.004.

Association, A.P., 2013. Diagnostic and Statistical Manual of Mental Disorders (DSM-5®).
Association, A.P., 2000. Diagnostic and Statistical Manual of Mental Disorders, 4th Edition, Text Revision, 4th ed. American Psychiatric Association, Washington, DC.
Atkinson, T.M., Rosenfeld, B.D., Sit, L., Mendoza, T.R., Fruscione, M., Lavene, D., Shaw, M., Li, Y., Hay, J., Cleeland, C.S., Scher, H.I., Breitbart, W.S., Basch, E., 2011. Using confirmatory factor analysis to evaluate construct validity of the brief pain inventory (BPI). J. Pain Symptom Manage. 41, 558–565. https://doi.org/10.1016/j.jpainsymman.2010.05.008.
Beck, A.T., Epstein, N., Brown, G., Steer, R.A., 1988. An inventory for measuring clinical anxiety: psychometric properties. J. Consult. Clin. Psychol. 56, 893–897.
Benazzi, F., 2009. What is hypomania? Tetrachoric factor analysis and kernel estimation of DSM-IV hypomanic symptoms. J. Clin. Psychiatry 70, 1514–1521. https://doi.org/10.4088/JCP.09m05090.
Benazzi, F., 2007. Delineation of the clinical picture of dysphoric/mixed hypomania. Prog. Neuropsychopharmacol. Biol. Psychiatry 31, 944–951. https://doi.org/10.1016/j.pnpbp.2007.02.015.
Benjamini, Y., Hochberg, Y., 1995. Controlling the false discovery rate: a practical and powerful approach to multiple testing. J. R. Stat. Soc. Ser. B Methodol. 57, 289–300.
Bentler, P.M., 1990. Comparative fit indexes in structural models. Psychol. Bull. 107, 238–246.
Bertszya, G., Gervasoni, N., Favre, S., Liberek, C., Ragama-Pardos, E., Aubry, J.-M., Gex-Fabry, M., Dayer, A., 2008. Frequency of dysphoria and mixed states. Psychopathology 41, 187–193. https://doi.org/10.1159/000120987.
Braden, W., Ho, C.K., 1981. Racing thoughts in psychiatric inpatients. Arch. Gen. Psychiatry 38, 71–75.
Cronbach, L.J., 1951. Coefficient alpha and the internal structure of tests. Psychometrika 16, 297–334. https://doi.org/10.1007/BF02310555.
Desseilles, M., Chang, T., Piguet, C., Bertschy, G., Dayer, A.G., 2012. A three-dimensional model of thoughts: insight into depression. Psychopathology 45, 203–214. https://doi.org/10.1159/000335073.
Diler, R.S., Goldstein, T.R., Hafeman, D., Merranko, J., Liao, F., Goldstein, B.I., Hower, H., Gill, M.K., Hunt, J., Yen, S., Keller, M.B., Axelson, D., Strober, M., Iyengar, S., Ryan, N.D., Birmaher, B., 2017. Distinguishing bipolar depression from unipolar depression in youth: preliminary findings. J. Child Adolesc. Psychopharmacol. 27, 310–319. https://doi.org/10.1089/cap.2016.0154.
Dilsaver, S.C., Chen, Y.R., Shoaib, A.M., Swann, A.C., 1999. Phenomenology of mania: evidence for distinct depressed, dysphoric, and euphoric presentations. Am. J. Psychiatry 156, 426–430. https://doi.org/10.1176/ajp.156.3.426.
Dodd, S., Kulkarni, J., Berk, L., Ng, F., Fitzgerald, P.B., de Castella, A.R., Filia, S., Filia, K., Montgomery, W., Kelin, K., Smith, M., Brnabic, A., Berk, M., 2010. A prospective study of the impact of subthreshold mixed states on the 24-month clinical outcomes of bipolar I disorder or schizoaffective disorder. J. Affect. Disord. 124, 22–28. https://doi.org/10.1016/j.jad.2009.10.027.
Faedda, G.L., Marangoni, C., Reginaldi, D., 2015. Depressive mixed states: a reappraisal of Koukopoulos' criteria. J. Affect. Disord. 176, 18–23. https://doi.org/10.1016/j.jad.2015.01.053.
Favre, S., Aubry, J.-M., Gex-Fabry, M., Ragama-Pardos, E., McQuillan, A., Bertschy, G., 2003. Translation and validation of a French version of the Young Mania Rating Scale (YMRS). L'Encephale 29, 499–505.
Ferrari, M., Ossola, P., Lucarini, V., Accardi, V., Panfilis, C.D., Tonna, M., Marchesi, C., 2016. Thought overactivation as a marker of bipolar disorder. Eur. Psychiatry 33, S264. https://doi.org/10.1016/j.eurpsy.2016.01.547.
Fiedorowicz, J.G., Endicott, J., Leon, A.C., Solomon, D.A., Keller, M.B., Coryell, W.H., 2011. Subthreshold hypomanic symptoms in progression from unipolar major depression to bipolar disorder. Am. J. Psychiatry 168, 40–48. https://doi.org/10.1176/appi.ajp.2010.10030328.
Goldberg, J.F., Garno, J.L., Portera, L., Leon, A.C., Kocsis, J.H., 2000. Qualitative differences in manic symptoms during mixed versus pure mania. Compr. Psychiatry 41, 237–241. https://doi.org/10.1053/comp.2000.7427.
Goldberg, J.F., Perlis, R.H., Bowden, C.L., Thase, M.E., Miklowitz, D.J., Marangell, L.B., Calabrese, J.R., Nierenberg, A.A., Sachs, G.S., 2009. Manic symptoms during depressive episodes in 1,380 patients with bipolar disorder: findings from the STEP-BD. Am. J. Psychiatry 166, 173–181. https://doi.org/10.1176/appi.ajp.2008.08050746.
Goodwin, F.K., Jamison, K.R., 2007. Manic-Depressive Illness: Bipolar Disorders and Recurrent Depression. Oxford University Press, USA.
Hersh, K., 2010. Rat Girl: A Memoir. Reprint ed. Penguin Books, New York.
Hu, L., Bentler, P.M., 1999. Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. Struct. Equ. Model. Multidiscip. J. 6, 1–55. https://doi.org/10.1080/10705519909540118.
Jackson, D.L., Gillaspy, J.A., Purc-Stephenson, R., 2009. Reporting practices in confirmatory factor analysis: an overview and some recommendations. Psychol. Methods 14, 6–23. https://doi.org/10.1037/a0014694.
Keizer, I., Piguet, C., Favre, S., Aubry, J.-M., Dayer, A., Gervasoni, N., Gex-Fabry, M., Bertschy, G., 2014. Subjective experience of thought overactivation in mood disorders: beyond racing and crowded thoughts. Psychopathology 47, 174–184. https://doi.org/10.1159/000354781.
Koukopoulos, A., Sani, G., Ghaemi, S.N., 2013. Mixed features of depression: why DSM-5 is wrong (and so was DSM-IV). Br. J. Psychiatry 203, 3–5. https://doi.org/10.1192/bjp.bp.112.124404.
Koukopoulos, A., Sani, G., Koukopoulos, A.E., Manfredi, G., Pacchiarotti, I., Girardi, P., 2007. Melancholia agitata and mixed depression. Acta Psychiatr. Scand. Suppl 50–57. https://doi.org/10.1111/j.1600-0447.2007.00963.x.
Kraepelin, E., 2008. La Folie Maniaco-Dépressive. Mollat, Bordeaux.
Le Carret, N., Lafont, S., Mayo, W., Fabrigoule, C., 2003. The effect of education on cognitive performances and its implication for the constitution of the cognitive reserve. Dev. Neuropsychol. 23, 317–337. https://doi.org/10.1207/

S15326942DN2303_1.
Lewis, E.J., Yoon, K.L., Joormann, J., 2017. Emotion regulation and biological stress responding: associations with worry, rumination, and reappraisal. Cogn. Emot. 1–12. https://doi.org/10.1080/02699931.2017.1310088.
Leyfer, O.T., Ruberg, J.L., Woodruff-Borden, J., 2006. Examination of the utility of the Beck Anxiety Inventory and its factors as a screener for anxiety disorders. J. Anxiety Disord. 20, 444–458. https://doi.org/10.1016/j.janxdis.2005.05.004.
Lufi, D., Segev, S., Blum, A., Rosen, T., Haimov, I., 2015. The effect of age on attention level: a comparison of two age groups. Int. J. Aging Hum. Dev. 81, 176–188. https://doi.org/10.1177/0091415015614953.
MacKinnon, D.F., 2008. Bipolar disorder as maladaptive arousal: a behavioral model and evidence. Ann. N. Y. Acad. Sci. 1129, 185–189. https://doi.org/10.1196/annals.1417.000.
Marchetti, I., Van de Putte, E., Koster, E.H.W., 2014. Self-generated thoughts and depression: from daydreaming to depressive symptoms. Front. Hum. Neurosci. 8, 131. https://doi.org/10.3389/fnhum.2014.00131.
Miller, S., Suppes, T., Mintz, J., Hellemann, G., Frye, M.A., McElroy, S.L., Nolen, W.A., Kupka, R., Leverich, G.S., Grunze, H., Altshuler, L.L., Keck, P.E., Post, R.M., 2016. Mixed depression in bipolar disorder: prevalence rate and clinical correlates during naturalistic follow-up in the Stanley bipolar Network. Am. J. Psychiatry 173, 1015–1023. https://doi.org/10.1176/appi.ajp.2016.15091119.
Perugi, G., Angst, J., Azorin, J.-M., Bowden, C.L., Mosolov, S., Reis, J., Vieta, E., Young, A.H., BRIDGE-II-Mix Study Group, 2015. Mixed features in patients with a major depressive episode: the BRIDGE-II-MIX study. J. Clin. Psychiatry 76, e351–e358. https://doi.org/10.4088/JCP.14m09092.
Piguet, C., Dayer, A., Kosel, M., Desseilles, M., Vuilleumier, P., Bertschy, G., 2010. Phenomenology of racing and crowded thoughts in mood disorders: a theoretical reappraisal. J. Affect. Disord. 121, 189–198. https://doi.org/10.1016/j.jad.2009.05.006.
Rush, A.J., Trivedi, M.H., Ibrahim, H.M., Carmody, T.J., Arnow, B., Klein, D.N., Markowitz, J.C., Ninan, P.T., Kornstein, S., Manber, R., Thase, M.E., Kocsis, J.H., Keller, M.B., 2003. The 16-Item Quick Inventory of Depressive Symptomatology (QIDS), clinician rating (QIDS-C), and self-report (QIDS-SR): a psychometric evaluation in patients with chronic major depression. Biol. Psychiatry 54, 573–583.
Sani, G., Vöhringer, P.A., Barroilhet, S.A., Koukopoulos, A.E., Ghaemi, S.N., 2018. The Koukopoulos Mixed Depression Rating Scale (KMDRS): an International Mood Network (IMN) validation study of a new mixed mood rating scale. J. Affect. Disord. 232, 9–16. https://doi.org/10.1016/j.jad.2018.01.025.
Sani, G., Vöhringer, P.A., Napoletano, F., Holtzman, N.S., Dalley, S., Girardi, P., Ghaemi, S.N., Koukopoulos, A., 2014. Koukopoulos' diagnostic criteria for mixed depression: a validation study. J. Affect. Disord. 164, 14–18. https://doi.org/10.1016/j.jad.2014.03.054.
Schreiber, J.B., Nora, A., Stage, F.K., Barlow, E.A., King, J., 2006. Reporting structural equation modeling and confirmatory factor analysis results: a review. J. Educ. Res. 99, 323–338. https://doi.org/10.3200/JOER.99.6.323-338.
Stahl, S.M., Morrissette, D.A., Faedda, G., Fava, M., Goldberg, J.F., Keck, P.E., Lee, Y., Malhi, G., Marangoni, C., McElroy, S.L., Ostacher, M., Rosenblat, J.D., Solé, E., Suppes, T., Takeshima, M., Thase, M.E., Vieta, E., Young, A., Zimmerman, M., McIntyre, R.S., 2017. Guidelines for the recognition and management of mixed depression. CNS Spectr. 22, 203–219. https://doi.org/10.1017/S1092852917000165.
Stöber, J., Bittencourt, J., 1998. Weekly assessment of worry: an adaptation of the Penn State Worry Questionnaire for monitoring changes during treatment. Behav. Res. Ther. 36, 645–656.
Suppes, T., Mintz, J., McElroy, S.L., Altshuler, L.L., Kupka, R.W., Frye, M.A., Keck, P.E., Nolen, W.A., Leverich, G.S., Grunze, H., Rush, A.J., Post, R.M., 2005. Mixed hypomania in 908 patients with bipolar disorder evaluated prospectively in the Stanley Foundation Bipolar Treatment Network: a sex-specific phenomenon. Arch. Gen. Psychiatry 62, 1089–1096. https://doi.org/10.1001/archpsyc.62.10.1089.
Swann, A.C., 2017. Mixed features: evolution of the concept, past and current definitions, and future prospects. CNS Spectr. 22, 161–169. https://doi.org/10.1017/S1092852916000882.
Treynor, W., Gonzalez, R., Nolen-Hoeksema, S., 2003. Rumination reconsidered: a psychometric analysis. Cogn. Ther. Res. 27, 247–259. https://doi.org/10.1023/A:1023910315561.
Tucker, L.R., Lewis, C., 1973. A reliability coefficient for maximum likelihood factor analysis. Psychometrika 38, 1–10. https://doi.org/10.1007/BF02291170.
Van der Gucht, E., Morriss, R., Lancaster, G., Kinderman, P., Bentall, R.P., 2009. Psychological processes in bipolar affective disorder: negative cognitive style and reward processing. Br. J. Psychiatry J. Ment. Sci. 194, 146–151. https://doi.org/10.1192/bjp.bp.107.047894.
Vandevoorde, J., Sanchez Valero, A., Baudoin, E., Kamar, S., Chabert, B., Baudoin, T., 2018. Measurement of flow of thought in 68 patients monitored in post-emergency outpatient consultations: role of ideational turmoil in the anxiety depressive symptomatology. L'Encephale 44, 308–314. https://doi.org/10.1016/j.encep.2017.05.005.
Weiner, L., Weibel, S., de Sousa Gurgel, W., Keizer, I., Gex-Fabry, M., Giersch, A., Bertschy, G., 2018. Measuring racing thoughts in healthy individuals: the Racing and Crowded Thoughts Questionnaire (RCTQ). Compr. Psychiatry 82, 37–44. https://doi.org/10.1016/j.comppsych.2018.01.006.
Young, R.C., Biggs, J.T., Ziegler, V.E., Meyer, D.A., 1978. A rating scale for mania: reliability, validity and sensitivity. Br. J. Psychiatry J. Ment. Sci. 133, 429–435.
Zeschel, E., Correll, C.U., Haussleiter, I.S., Krüger-Özgürdal, S., Leopold, K., Pfennig, A., Bechdolf, A., Bauer, M., Juckel, G., 2013. The bipolar disorder prodrome revisited: is there a symptomatic pattern? J. Affect. Disord 151, 551–560. https://doi.org/10.1016/j.jad.2013.06.043.