Cyclothymic temperament: Associations with ADHD, other psychopathology, and medical morbidity in the general population

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ABSTRACT

Background: Cyclothymic temperament (CT) is an affective disposition often preceding bipolar disorder (BD), and is the most common affective temperament in patients with BD. In depressed patients, CT is a predictor for developing a bipolar course. In a clinical sample of adults with BD and attention deficit hyperactivity disorder (ADHD), CT was associated with higher loads of psychiatric symptoms, somatic comorbidity, impairment, and higher morbidity among first-degree relatives. We aimed to investigate the morbidity and occupational functioning of persons with CT in the general population.

Methods: Randomly recruited Norwegian adults (n = 721) were assessed with a 21-item cyclothymic subscale from the TEMPS Autoquestionnaire. Self-reported data were collected on psychiatric symptoms, comorbidity, educational and occupational level, and known family morbidity.

Results: Thirteen percent had CT associated with an increased prevalence of ADHD, BD, high scores on the Mood Disorder Questionnaire (MDQ), and childhood and adulthood ADHD symptoms. CT was found in 75% ($p<0.001$) of the bipolar participants, and in 68% ($p<0.001$) of those with a positive MDQ score. CT was associated with more anxiety/depression, substance and alcohol problems, lower educational and occupational levels, and having a first-degree relative with anxiety/depression, alcohol problems, ADHD, and BD.

Limitations: The CT subscale alone might include overlapping features with cyclothymic, anxious, irritable, and depressed temperaments, thus increasing the prevalence estimate of CT.

Conclusions: CT is a strong predictor of occupational failure and associated with more psychiatric impairment in the participants and their families. CT should be assessed in both mood disorder and ADHD patients.

Keywords:

Temperament Evaluation of Memphis, Pisa, Paris and San Diego Autoquestionnaire (TEMPS-A)

Cyclothymic temperament

General population

Bipolar disorder

ADHD

Comorbidity

Highlights

- Cyclothymic temperament (CT) predicts low functioning and alcohol and drug problems in the general population
- CT is associated with increased morbidity in the participants and their family.
- ADHD was associated with an increased prevalence of bipolar disorder, even stronger in the presence of CT.
- CT reveals more impairment with a higher risk of a poor outcome and should be evaluated in both mood disorder and ADHD patients.

1. Introduction

The existence of different temperament traits and their possible relationship to mood disorders has long been recognized. Kraepelin (1921) described cyclothymic temperament (CT) [1] and regarded it as a subthreshold manifestation of "manic-depressive insanity." Akiskal (1983) rediscovered Kraepelin's contribution to the dimensional understanding of psychopathology and proposed five affective temperaments, which are now viewed as being either subsyndromal manifestations of mood disorders or a risk factor for developing one of them (Rihmer et al., 2010).

The Temperament Evaluation of Memphis, Pisa, Paris and San Diego Autoquestionnaire (TEMPS-A) was developed by Akiskal et al. (2005b) to assess affective temperaments, and contains subscales measuring cyclothymic, dysthymic, hyperthymic, irritable, and anxious temperaments.

CT often precedes the onset of a bipolar disorder (BD), and when present in a depressed patient, is a powerful predictor of the development of a bipolar course (Kochman et al., 2005; Rihmer et al., 2010).

Mood instability is also an important characteristic among patients with attention deficit hyperactivity disorder (ADHD), even though it is not included in the diagnostic criteria for this disorder. In the DSM-IV/5 however, emotional instability/dysregulation is listed as an associated symptom to ADHD (American Psychiatric Association, 2013). Affective symptoms were first recognized as part of ADHD in children (Laufer and Denhoff, 1957; Sorensen et al., 2008), and subsequently in adults (Reimherr et al., 2005).

ADHD and BD coexist at a higher rate than prevalence estimates for each of them in the general population (Singh et al., 2006) but this comorbidity is also debated (Wingo and

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[1] CT abbreviation for Cyclothymic temperament, CT-TEMPS-A; CT subscale of TEMPS-A, CT-TEMPS pos.; a positive score on the CT-TEMPS-A, defined as having CT.

Ghaemi, 2007).The high rate of co-occurrence of BD and ADHD is thought to be independent of the mood state (Di Nicola et al., 2014). The DSM-IV (American Psychiatric Association, 2000) and DSM-5 (American Psychiatric Association, 2013) define both disorders as having key symptoms involving dysregulation of energy, activity, affect, and impulsivity. Both conditions are also considered highly heritable (Faraone and Larsson, 2018; Wray and Gottesman, 2012).

Previous studies have shown an increased prevalence of bipolar spectrum disorders (BSDs) in ADHD patients, as assessed using the Mood Disorder Questionnaire (MDQ) (Halmøy et al., 2010). Vannucchi et al. (2019) found that in patients with major depressive disorder, comorbid current ADHD was associated with bipolar diathesis, mixed features, multiple comorbidity, and a more unstable course. Other authors have implied a cyclothymic-anxious-sensitive temperamental disposition to have a mediating role for affective lability and emotional over-reactivity (Perugi et al., 2015). The ADHD patients with CT had a higher score on the MDQ, the Wender Utah Rating Scale (WURS), and the Adult ADHD Self-Report Scale (ASRS). ADHD patients who reported BD also fulfilled the criteria for CT. Patients with CT had a lower functioning level with less education, lower occupational rate, and increased impairment from psychopathology and comorbidity, including BD (Landaas et al., 2012). These findings were suggested to stem from an underlying affective instability, providing linkage to BSDs (Landaas et al., 2012). Similar emotional dysregulation is also reported in ADHD by Richard-Lepouiriel et al. (2016). Pinna et al. (2019) found that co-occurrence with ADHD and BD had several unfavorable outcomes as lower education, higher psychiatric comorbidity, drug and alcohol use as well as a tendency toward [hypo]mania.

Landaas et al. (2012) also showed that ADHD patients with BSDs met the TEMPS-A threshold for CT (CT-TEMPS positive). The CT-TEMPS positive patients reported more BD in first-degree relatives, while ADHD was more common among first-degree relatives of the

ADHD patients who scored below this threshold (CT-TEMPS negative) (Landaas et al., 2012). This is in line with findings from a French study where ADHD and impulse control disorders had a higher prevalence among depressive patients with a family history of BD. CT was a major risk factor for a family history of affective illness (i.e., BD and mania). These comorbidities were related to difficulties in school and behavioral problems (Azorin et al., 2016).

From this background, we attempted to determine whether CT with and without the presence of ADHD is associated with higher levels of morbidity, lower occupational functioning, lower educational attainment, and impaired function in a general population sample. We also explored the impact of CT on morbidity in their first-degree relatives.

2. Method

2.1. Participants

A randomly selected sample of 2963 individuals throughout Norway, aged 18–40 years, was invited to participate in this study. 721 responded and was included in the study. The Medical Birth Registry of Norway was used to select a sample from the general population, and covered most of the geographical regions in Norway. All participants signed a written informed consent form. There were no exclusion criteria. A detailed description of the sample and procedures is provided in previous publications (Halmøy et al., 2009, 2010; Landaas et al., 2012). The study was approved by the Regional Committee for Medical Health Research Ethics (IRB #3 (FWA00009490, IRB00001872)).

2.2. Measures

The respondents completed a questionnaire containing items on educational level, occupational status, and current or lifetime psychiatric disorders, including any psychiatric

morbidity known to the participants in their first-degree relatives. No other data on the first-degree relatives were available.

In addition, four standardized self-report questionnaires were used: the cyclothymic subscale of the TEMPS-A (CT-TEMPS-A) (Akiskal and Akiskal, 2005), the MDQ screening for BSDs (Hirschfeld et al., 2000), the 25-question version of the WURS (WURS-25), which screens for ADHD in childhood (Ward et al., 1993), and the ASRS, which measures current ADHD symptoms (Kessler et al., 2005).

2.2.1. The Adult ADHD Self-Report Scale (ASRS)

The ASRS is the World Health Organization's rating scale, designed to measure current symptoms of ADHD in adults. It is validated (Adler, 2006; Kessler et al., 2005) and consists of 18 questions that follow the DSM-IV criteria for ADHD. It uses a five-point scale (0 = never, 4 = very often), with a possible range of scores from 0 to 72. In the version used in this study, items 1–9 cover symptoms of inattention and 10–18 cover hyperactivity and impulsivity (Kessler et al., 2005, 2006). A positive ADHD screen was defined as having a score of 21 or more on either of the ASRS subscales (Kessler et al., 2005).

2.2.2. The Wender Utah Rating Scale, 25 question-version (WURS-25)

The WURS-25 is a 25-item self-rating scale designed to assess ADHD-related symptoms, behavioral disturbance, depression, anxiety, and signs of ADHD in childhood. It uses a five-point Likert scale (0 = never, 4 = very often), yielding a possible score range of 0–100. A cutoff score of 36 or more identified 96% of adults with ADHD. Ward et al. (1993) described the WURS-25 as being the best for differentiating between ADHD patients and normal comparison participants, with a screening window of 35–46 (Rasmussen et al., 2001).

2.2.3. The Mood Disorder Questionnaire (MDQ)

The MDQ screening instrument for BSDs has been validated in both clinical and control populations. It is a self-report form that consists of 15 questions scored "yes" or "no." The first 13 items explore lifetime symptoms of mania/hypomania, and the last two items rate co-occurring symptoms and the degree to which the symptoms cause functional impairment. A positive MDQ score is, as a standard, defined as seven or more "yes" answers on the first 13 items, a "yes" on question 14 (co-occurrence of symptoms), and "level 3 or more" on question 15 (moderate to severe impairment) (Halmøy et al., 2009). Validation of the MDQ has been performed both in psychiatrically ill and healthy individuals (Hirschfeld et al., 2000, 2003).

2.2.4. The TEMPS-A Cyclothymic Temperament Subscale (CT-TEMPS-A)

The CT-TEMPS-A is a self-report form that consists of 21 questions covering CT according to Akiskal's definition (Akiskal et al., 2005b). This subscale is part of the larger TEMPS-A Autoquestionnaire (Akiskal et al., 2005a). Akiskal and Mallya (1987) developed the criteria to measure affective temperaments. These are based on a continuum between affective temperaments and mood disorders, and were first developed as an interview version. The autoquestionnaire, TEMPS-A, was later published by Akiskal and Akiskal (2005), and has been validated for use in both psychiatrically ill and healthy individuals. The complete questionnaire consists of five subscales, with items based on the diagnostic criteria for cyclothymic, dysthymic, hyperthymic, irritable, and anxious temperaments. The CT-TEMPS-A used in this study contains 21 statements describing a person's emotionality and reaction style. It was chosen because it rates mood instability, which is relevant to ADHD. Items answered "true" accrue one point, while items answered "false" accrue no points. The scale can be analyzed as both a continuous and a dichotomous measure. When analyzed

dichotomously, a positive score is defined as ≥ 11 points (Akiskal et al., 2005b); in our study, this was labeled “CT-TEMPS positive” and the participant was considered to have CT.

2.3. Statistical analyses

Of 721 participants, 690 (95.7%) completed the CT-TEMPS-A questionnaire. We found no difference in age or gender between those who completed the questionnaire and those who did not. A relationship was observed between “missingness” and some variables, which implied deviation from the assumption “missing completely at random” (Schafer and Graham, 2002). Not completing a valid subscale was related to more asthma, anxiety/depression, treatment for a psychiatric disorder, a lower level of education, more dyslexia in participants and first-degree relatives, and higher scores on several ASRS and WURS items. In the present study, multiple imputation was used to estimate plausible values where data were missing. CT-TEMPS-A and other variables were used as predictors. The very small amount of missing data meant that this was a minor problem in the sample. Descriptive statistics (mean, median, variance), frequencies, crosstab analyses, and multiple imputation were performed using SPSS software (version 21.0; IBM SPSS, Armonk, NY, USA).

SPSS was also used to test mean differences (t-tests and ANOVA) and to analyze correlations (Pearson for continuous variables and Spearman for ordinal variables) and regression models.

3. Results

3.1. Prevalence of CT in the general population

Thirteen percent of the general population sample fulfilled the criterion for CT (i.e., had scores above the threshold on the CT-TEMPS-A) (Akiskal et al., 2005b).

The mean CT-TEMPS-A score was 4.65 (SD=4.62). The distribution was somewhat positively skewed (skewness=1.19), indicating a larger proportion of the sample with no score or low levels on the scale (see Fig. 1).

3.1.1. Prevalence of CT related to sociodemographic data

The mean age in the entire sample was 30 years with a normal distribution. Almost all respondents reported being in work, with only a few percent unemployed, on sick leave, or receiving disability benefits (Table 1). However, a positive score on the CT-TEMPS-A was a strong predictor for a lower level of functioning with a lower educational level, lower rate of employment, and higher morbidity.

The mean sum score did not differ between women (mean = 4.74) and men (mean = 4.52, t=−0.61, p=.542, equal variances not assumed).

3.2. Clinical characteristics in the general population related to CT

Participants with CT had a significantly higher percentage of self-reported psychiatric morbidity; anxiety/depression, BD, and alcohol and drug problems (Table 2 and Fig. 2). A similar pattern was also reported for their first-degree relatives, who had significantly elevated rates of alcohol problems (Table 3 and Fig. 3), but not drug problems.

3.2.1. The cyclothymic subscale of TEMPS-A, MDQ, and BD

In the total sample, 1.4% self-reported having been diagnosed with BD. Of these, almost two-thirds screened positive for CT. In total, 6.3% (n=45) had a positive MDQ score, which is a much higher prevalence than that for the strict definition of BD. Among those with a positive MDQ score, 68% also had CT (n=27).

More of those in the CT-TEMPS positive group reached the MDQ positive threshold (32%) than those in the CT-TEMPS negative group (2.2%); this difference was statistically

significant (p<.001). The correlation between the variables was: r=.42 (p=.001, Spearman). The CT-TEMPS positive group also had a higher mean sum score on the MDQ.

More individuals with CT had received psychiatric treatment and more often reported having received a diagnosis of BD compared with those without CT (Table 2). Of those who self-reported BD, 57% were MDQ positive. However, only 9.1% of those scoring positive on the MDQ had a self-reported BD. Thus, 91% of individuals screening positively for a BSD had never been diagnosed or treated for a BD, and 31% of these had CT.

3.2.2. CT, ADHD, and BSDs

Eleven percent of our sample had a positive ASRS score. CT was related to a higher score on the WURS and a higher ASRS total score (Table 2). CT-TEMPS positive participants showed a higher prevalence of the combined subtype of ADHD symptoms (i.e., over the threshold on both the inattention and the hyperactive/impulsive subscales of the ASRS, respectively) compared with the CT-TEMPS negative participants. CT was associated with an increased prevalence of BSDs in the whole sample.

The presence of ADHD symptoms was also significantly associated with an increased prevalence of BSDs, and when CT was present, the prevalence increased further from 32% to 47% (Table 2).

3.3. Psychiatric and somatic morbidity in individuals with CT and their first-degree relatives

The frequencies of self-reported diseases are presented in Table 2 and Fig. 2. Morbidity in the participants' first-degree relatives is shown in Table 3 and Fig. 3.

We found a significantly increased morbidity in participants with CT and their first-degree relatives. The strongest relations were between those with CT and the dyslexia and anxiety/depression variables. In the whole sample, 22% had tried illegal drugs. We found that twice as many with CT had tried illegal substances compared with those without. Among the

participants who reported drug problems, 67% had CT. Their first-degree relatives also showed significantly more problems with alcohol. The difference for drug problems was not statistically significant. Anxiety/depression, BD, alcohol problems, dyslexia, migraine, and other psychiatric conditions were significantly increased in the participants with CT and their relatives. Participants with CT also reported a higher prevalence of both ADHD and BD among their first-degree relatives.

4. Discussion

In this sample of the Norwegian general population, we found that 13% had CT; 6.3% had a BSD based on MDQ screening, and 1.4% had a known self-reported BD. The presence of CT was significantly associated with an elevated prevalence of BD, and higher MDQ, ASRS, and WURS scores. Consistent with this finding, individuals with CT were more likely to have used psychiatric services and to have received a diagnosis of BD.

We found that having CT was related to having a lower level of educational attainment. This was also reported by Yazici et al. (2014), who found CT to be related to lower educational level in young pregnant women. We also found a lower likelihood of employment, and an increase in somatic and psychiatric morbidity in both the participants and their first-degree relatives. Others have reported that while the same is true for those with ADHD and BSD, the association is even greater among those with CT (Brus et al., 2014; Halmøy et al., 2009; Landaas et al., 2012). The findings also add support to mood instability being a prominent feature of ADHD.

More individuals with CT than without had received psychiatric treatment and had self-reported BD.

Our findings are consistent with Endicott's (1989) concept of a psychophysiological dimension termed 'bipolarity.' Endicott postulated that this dimension applies to all affective disorders, and proposed a possible link between bipolarity and several 'anomalous' brain

conditions or phenomena (ABCPs), including enuresis, Raynaud's phenomena, mixed- or left-handedness, and learning and speech disorders. He suggested a link between a 'non-bipolar I' continuum and various psychophysiological phenomena, including dyslexia, reflecting the dysregulation of several central nervous system processes related to the expression of emotion, energy, and associated functions. These might be used as 'markers' for the patterns of functional brain organization with which they are associated. Endicott (2004) later suggested that several ABCPs are linked to migraine and bipolarity.

We found an association between migraine and CT. Studies of both epidemiological (Jette et al., 2008; Low et al., 2003; McIntyre et al., 2006) and clinical samples (Fasmer, 2001; Fasmer and Oedegaard, 2002; Fornaro et al., 2015; Fornaro and Stubbs, 2015; Mahmood et al., 1999; Ortiz et al., 2010; Saunders et al., 2014) have revealed a strong link between BD, especially BDII, and migraines. Fasmer (2001) reported that seven of 11 participants with CT in a database of 62 had migraines.

We also found that not only were participants with CT more likely to have a history of academic difficulties, but also that the same also applied to their first-degree relatives. Consistent with this, Azorin et al. (2016) found that the first-degree relatives of those with major depressive disorder and a family history of mania had more difficulties in school than those without such a family history.

Our findings also point to more severe childhood and current symptoms of ADHD in participants with CT compared with those without. Skala et al. (2016) described an association between the presence of CT and the severity of past and present symptoms of ADHD. We have observed a similar association in clinical samples of adult ADHD (Landaas et al., 2012).

The results are also consistent with reports of an increased prevalence of substance use disorders (Silva et al., 2014), and alcohol and substance use in patients with ADHD and BD

(Halmøy et al., 2010). A more severe course of alcohol abuse/dependence has been related to CT (Pombo et al., 2013). Of the total sample, 6.3% screened positive for a BSD on the MDQ. However, >90% of these did not report having been diagnosed with a BD. This gap between having a positive MDQ score and not having been diagnosed with a BD was also described by Halmøy et al. (2010), and suggests a high prevalence of unrecognized BSD in Norway.

We found that 75% of those who screened positive for a BSD had CT. This high prevalence is in line with research findings from clinical settings (Landaas et al., 2012).

In family genetic studies, a strong aggregation of cyclothymic and hyperthymic temperaments has been documented in non-affected first-degree relatives of patients with bipolar I disorder (BDI) (Chiaroni et al., 2005; Evans et al., 2005; Mendlowicz et al., 2005). CT is the most common affective temperament type among patients with bipolar II disorder (BDII) (Rihmer et al., 2010). Healthy controls without a family history of affective disorders showed the lowest mean cyclothymic and hyperthymic scores, whereas recovered BDI patients exhibited the highest scores. Individuals with BD and their healthy relatives can be reliably differentiated from healthy controls by degree of CT (Vazquez et al., 2008).

There is an increased occurrence of affective temperaments in the first-degree relatives of individuals with BD; in particular, the rate of CT is high (Chiaroni et al., 2005; Evans et al., 2005; Klein et al., 1985; Maier et al., 1995; Rihmer et al., 2010). CT may be the main mechanism by which bipolar risk is passed between generations (Akiskal et al., 2006). Temperament may contribute to instability of affect, emotion, activity, and sleep, which increases the risk of developing fully syndromal BD (Akiskal et al., 2006; Vazquez et al., 2008).

The presence of CT in the context of unipolar depression predicts conversion to BDII (Akiskal et al., 1995, 2005a). Rapid shifts in mood and energy, which are core features of

CT, have been observed in some depressed patients, predominantly those with a family history of BD (Hantouche & Akiskal, 2008).

CT-TEMPS positive participants had a significantly lower level of education than CT-TEMPS negative participants; most CT-TEMPS positive participants had completed only senior high school, whereas most of the CT-TEMPS negative participants had completed college or university. The CT-TEMPS positive participants were also more likely to be unemployed or otherwise not participating in the workforce. Landaas et al. (2012) found that the same pattern also applies to ADHD patients with CT.

Schoeyen et al. (2011) found that patients with BD had similar levels of education, but lower socioeconomic status than the general population. The only clinical characteristics associated with low educational level were rapid cycling and recurrent depressive episodes. This may be due to an association with CT (Azorin et al., 2008, 2015). In Landaas' study, CT was associated with an increased prevalence of BSDs and higher MDQ scores in 586 participants with ADHD. The presence of ADHD was also associated with a higher prevalence of BSDs, but significantly more so when CT was present (Landaas et al., 2012).

A comparative meta-analysis of TEMPS scores found that cyclothymic and irritable temperament scores were higher in BD than in major depressive disorder, and lowest in healthy controls (Solmi et al., 2016). The patients with atypical depression or BDII depression seemed to have a strong relationship with CT, while BDI and manic patients had higher hyperthymic scores. The present study also suggested common temperamental features between ADHD and BD, underpinning a shared biological background.

The importance of distinguishing patients with ADHD from BSD has been emphasized in the literature (Brus et al., 2014; Halmøy et al., 2010; Landaas et al., 2012), and it has been proposed that CT may be a trait that makes individuals with ADHD more sensitive to

environmental factors that elicit mood disruption compared with those in the general population (Landaas et al., 2012).

The CT-TEMPS-A is easy to administer and could be a useful tool in the clinical setting, increasing surveillance and affecting treatment choices (Dembinska-Krajewska and Rybakowski, 2014; Solmi et al., 2016), such as lithium (Koek et al., 2012). In this regard, early assessment of CT in patients with depression may be useful in introducing interventions aimed at preventing the cycle of mood fluctuations in individuals predisposed to rapid cycling (Koukopoulos et al., 2003, 2007; Kukopulos et al., 1983).

Furthermore, CT is also associated with poor treatment adherence (Fornaro et al., 2013) and is a risk factor for suicidal behavior, perhaps through its association with hopelessness (Solmi et al., 2016).

4.1. Limitations

The results in this study were obtained by self-report questionnaires only. Both the ASRS and the MDQ have yet to be subjected to official validation in Norway (Halmøy et al., 2010). However, these instruments have been validated in studies in the United States and Europe. In studies from other countries using non-validated national MDQ versions, one has found results comparable to studies in countries where it has been validated (Halmøy et al., 2010; Isometsa et al., 2003; Mantere et al., 2004). Only 24% of those initially invited to participate in this study chose to participate, and those who did were relatively young. Therefore, generalization of the results to the total Norwegian population must be done with caution. In the present sample, 6.3% had a positive screen on the MDQ. This is close to the prevalence of BSDs in the United States using DSM-IV criteria (4.4%–6.4%) (Judd and Akiskal, 2003; Merikangas et al., 2007).

Similarly, in a large community screening study performed by Hirschfeld et al. (2005), 3.2%–9.3% of the population between the ages of 18 and 44 years had BSD according to the

MDQ screen. We also found that the reported levels of lifetime depression/anxiety (16%) and known BD (1.4%) were close to the prevalence rates obtained in epidemiologic studies in Norway and other countries (Halmøy et al., 2010; Kessler et al., 2007; Kringlen et al., 2001). Therefore, our results are in line with population studies from other countries.

The TEMPS-A has been officially validated in the United States and in European countries (Akiskal et al., 2005b), but not yet in Norway. The scale has, however, been translated by a clinically experienced psychiatrist and retranslated by a certified translator, and has been used in clinical settings in Norway since 2003 (Landaas et al., 2012). Further, we used only one of the five scales from the TEMPS-A. This may have caused the rate of CT to be higher than has been reported from other studies using the full set of TEMPS-A scales.

An explanation for this could be that individuals with other temperaments have some overlapping symptoms with the CT subscale; therefore, presenting the CT subscale alone may capture some of these individuals, increasing the prevalence of CT in the population. The CT subscale used alone might differentiate only between mood instability and mood intensity rather than between the different temperaments.

Perugi et al. (2012) states on page e48, that the TEMPS-A has been found to reliably isolate "two fundamental temperamental dispositions: the first characterized by rapid fluctuations of mood and emotional instability, and the second by hyperactivity, high level of energy and emotional intensity." Our findings are, however, congruent with findings using the full TEMPS-A scale, showing that cyclothymic, irritable, and anxious temperament, but not depressive and hyperthymic temperament, are associated with increased severity of past and present ADHD symptoms (Skala et al., 2016). Regardless of this, we have shown that the CT subscale in and of itself could be clinically useful, as it significantly delineates individuals in the population with higher morbidity and impairment, even without including information on other temperamental traits.

Our findings have implications for how patients presenting with features of a mood disorder, especially depressive features, are evaluated and treated. Thus, patients with CT have a higher risk of comorbidities and complications and might need a more 'tailored' approach to psychotherapy, psychoeducational, and medication strategies than patients with other temperaments (Kukopulos et al., 1983, Koukopoulos et al., 2003; Rihmer et al., 2010; Perugi et al., 2015).

5. Conclusion

In conclusion, the presence of CT in the general Norwegian population is strongly related to lower levels of functioning, education, and participation in the workforce, as seen in earlier findings derived from clinical samples. It is also an indicator of the increased presence of psychiatric morbidity and substance abuse, and the presence of both somatic and psychiatric illness in their first-degree relatives. ADHD was associated with an increased prevalence of BD, but the relationship between the two was even stronger when CT was present at the same time. We conclude that CT in those requiring mood disorder or ADHD evaluation may indicate a more impaired subgroup of patients with a higher risk of a poor outcome. This indicates the importance of taking temperament characteristics into account in the clinical evaluation of both mood disorder and ADHD patients.

Conflict of interest

Jan Haavik has received speaker honoraria from Lilly, Shire, HB Pharma, Medice, and Biocodex. None of the other authors has any conflicts of interest.

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Contributors

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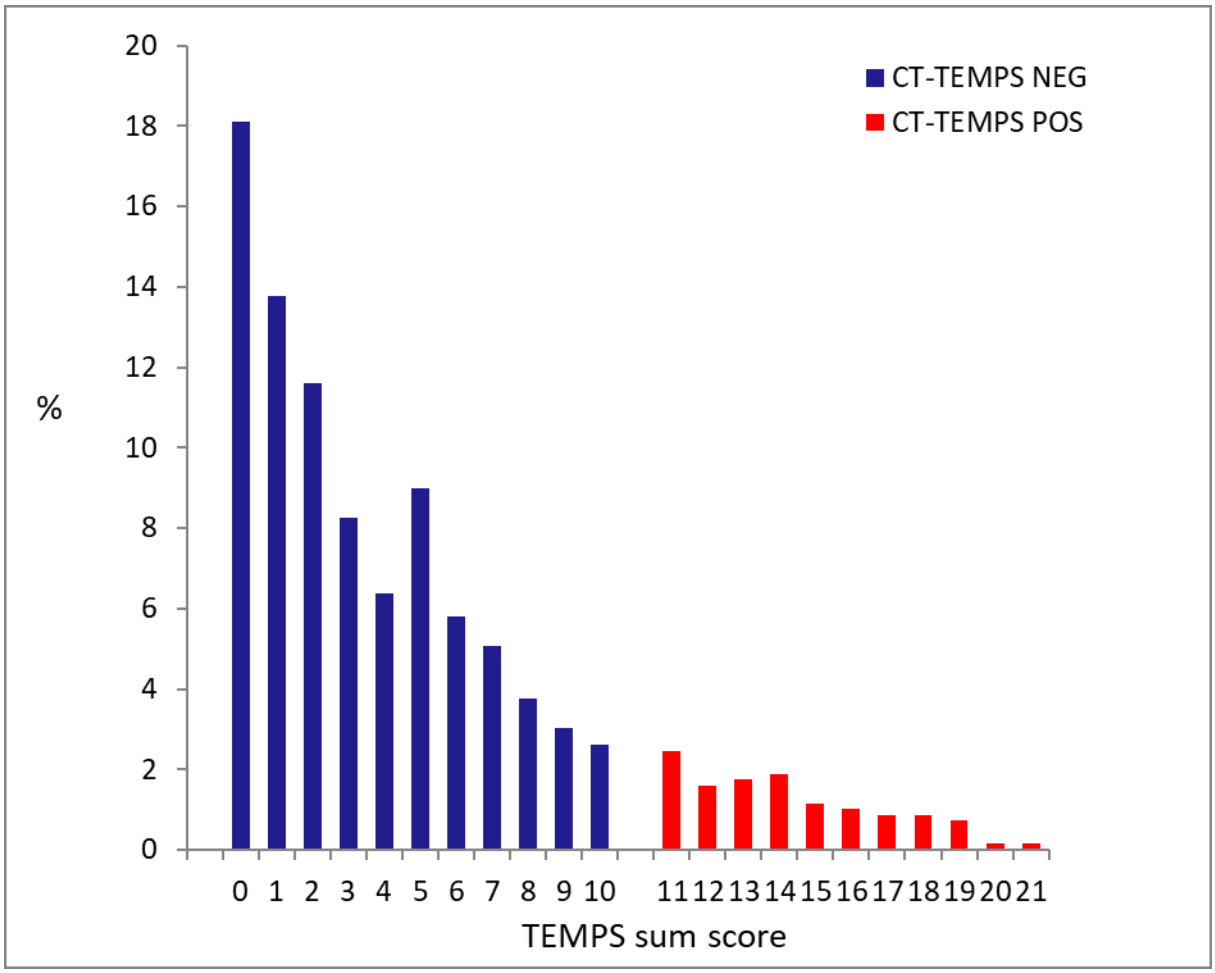

Fig. 1. The TEMPS-A cyclothymic subscale sum score distribution in the general population.

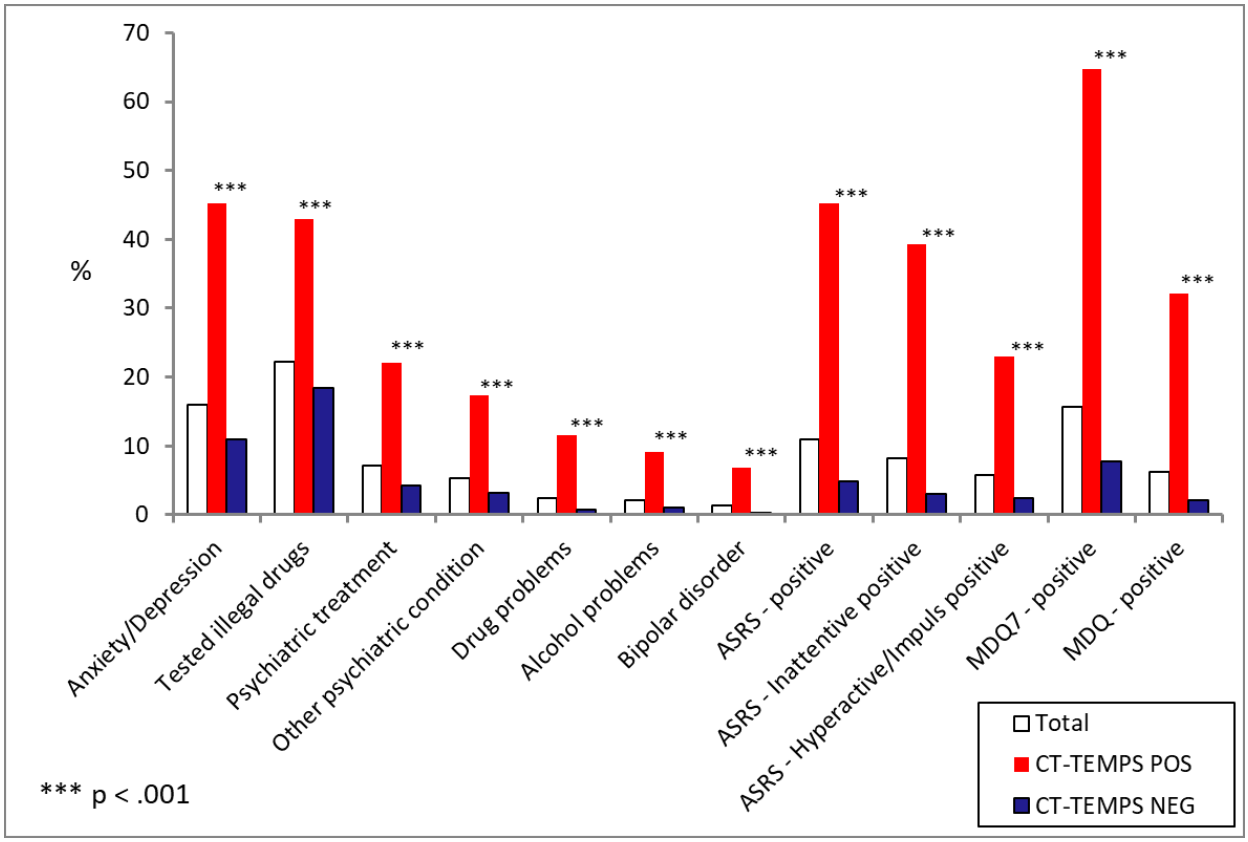

Fig. 2. Clinical characteristics of participants with cyclothymic temperament. Self- reported somatic, psychiatric morbidity, ratings on ADHD and bipolar spectrum disorders in the total sample and in the sample scoring positive on the TEMPS-A cyclothymic subscale.

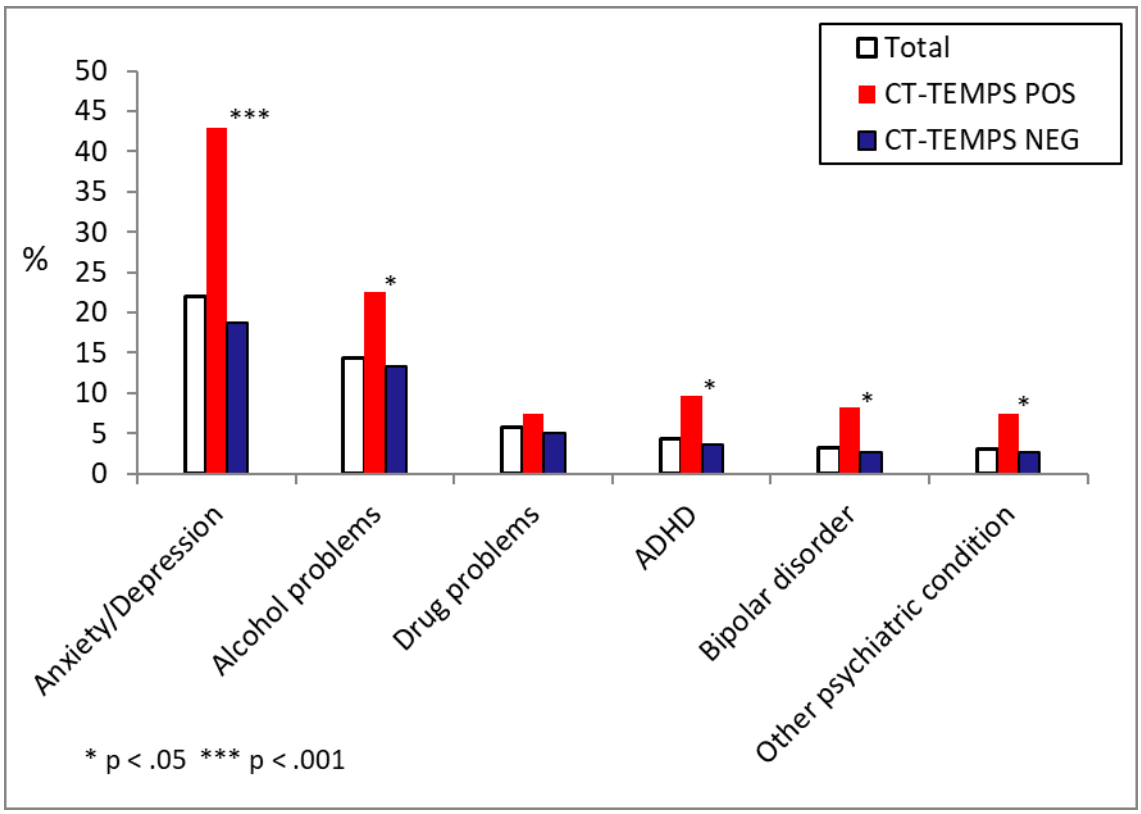

Fig. 3. Reported family diseases in relatives of participants with cyclothymic temperament.

Table 1

Educational- and occupational level in participants with cyclothymic temperament

Characteristics	Total (*n*=690)	CT-TEMPS positive (*n*=87)	CT-TEMPS negative (*n*=603)	r^{2a}	*p*
Female (%)	59.4	51.7	59.5	.06	.167
Age: mean (SD)	29.62 (6.48)	29.02 (6.72)	29.72 (6.46)	.00	.352
Educational level (%)					
- College/university	59.4	39.5	62.1		
- Senior high school	36.4	50.6	34.4		
- Junior high school	4.2	9.9	3.4	.03	.000
Occupational level (%)					
- Employed	80.5	72.2	81.7		
- Sick-leave, temporary	3.1	2.5	3.2		
- Disabled	1.7	3.8	1.3		
- Rehabilitation	2.6	6.3	2.1		
- Unemployed	1.7	6.3	1.0		
- Other	10.4	8.9	10.6	.01	.001

[a] Spearman correlation squared/eta squared for t-test

Table 2

Clinical characteristics of participants with cyclothymic temperament. Self-reported somatic and psychiatric morbidity, and ADHD and bipolar spectrum disorder ratings in relation to CT.

Characteristics	Total (*n*=690)	CT-TEMPS positive (*n*=87)	CT-TEMPS negative (*n*=603)	$r^{2\,a}$	*p*
Somatic morbidity (%)					
Migraine	19.3	33.3	17.1	.02	.000
Dyslexia	12.3	31.0	8.5	.06	.000
Asthma	11.3	15.1	10.1	.00	.165
Psychiatric morbidity (%)					
Tested illegal drugs	22.3	43.0	18.4	.04	.000
Anxiety/depression	16.1	45.3	10.9	.10	.000
Psychiatric treatment	7.1	22.1	4.3	.06	.000
Other psychiatric condition	5.3	17.4	3.2	.05	.000
Drug problems	2.5	11.5	0.8	.06	.000
Alcohol problems	2.1	9.2	1.0	.04	.000
Bipolar disorder*	1.4	6.9	0.3	.04	.000
Bipolar spectrum and ADHD					
MDQ sum score	2.91 (3.22)	7.45 (3.18)	2.17 (2.54)	.31	.000
MDQ pos. (%)	6.3 n=44	32.1 n=27	2.2 n=13	.17	.000
WURS score: mean (SD)	17.48 (14.03)	36.85 (15.03)	14.27 (10.64)	.31	.000
ASRS score: mean (SD)	22.89 (10.02)	36.02 (9.53)	20.55 (7.96)	.28	.000

ASRS, Total (%)	10.9	n=76	45.2	n=38	4.9	n=29	.20	.000
- Combined (%)	3.1	n=22	82.4	n=14	17.6	n=3	.27	.002
- Inattentive (%)	8.2	n=58	39.3	n=33	3.0	n=18	.21	.000
- Hyperactive/impulsive (%)	5.8	n=41	23.0	n=20	2.4	n=14	.10	.000
ASRS pos. and MDQ pos.	30.6	n=22	47.2	n=17	3.7	n=1	.23	.000
ASRS neg. and MDQ pos.	3.2	n=19	17.8	n=8	2.0	n=11	.06	.000
Bipolar disorder* and MDQ (%)								
Bipolar disorder* and MDQ pos.	57.1	n=4	50	n=2	50	n=2	.00	.999
MDQ pos. and no bipolar disorder* diagnosis	90.9	n=40	31.3	n=25	2	n=12	.17	.000

[a] Spearman correlation squared/eta squared for t-test

*self-reported

Table 3

Reported diseases in first-degree relatives of participants with cyclothymic temperament

Diseases and treatment	Total % *n*=690	CT-TEMPS Pos.% *n*=87	CT-TEMPS Neg.% *n*=603	r^2	*P*
Migraine	30.1	44.2	27.8	.01	.003
Asthma	26.5	38.3	24.8	.01	.010
Anxiety/depression	22.0	42.9	18.8	.03	.000
Dyslexia	21.0	41.7	17.3	.04	.000
Alcohol problems	14.4	22.5	13.3	.01	.028
Drug problems	5.7	7.4	5.1	.00	.475
ADHD	4.4	9.7	3.6	.01	.015
Bipolar disorder	3.2	8.2	2.6	.01	.010
Other psychiatric condition	3.1	7.4	2.7	.01	.038